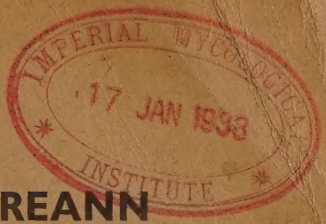
PAMPHLET COLL.



SAORSTÁT EIREANN
(Irish Free State).

AN ROINN TALMHAÍOCHTA
(Department of Agriculture).

POTATO GROWING
FOR
SEED PURPOSES

W. D. DAVIDSON, B.A., B.Sc., N.D.A. (Hons.)

"I resolve never to put out anything which is not as perfect as it is possible for me to make it."
—John Ray, 1663.

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Two Shillings and Sixpence.

Fig. 1.—View of Seed Potato growing district, N.W. Donegal. Muckish in the background.

With the Authors compliments.

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Few men achieve any great success in an occupation that they have not some pride and pleasure in pursuing.
—*Farmers' Magazine*, 1858.

INTRODUCTION.

The production of high-class seed potatoes is a comparatively new industry in Ireland. The natural advantage possessed by this country, in the special suitability of its soil and climate for the raising of healthy vigorous stocks, has only recently been appreciated.

In many countries potato growers must procure a change of seed to maintain the vigour of their stocks. Although seed growing as an industry is of recent growth in the Irish Free State, seed potatoes are now being exported to Great Britain, France, Spain, Portugal, Canary Islands, South Africa, Malta, Cyprus, Greece, Palestine, Spanish Morocco, French Morocco, Algeria, Tunisia, Egypt, Belgium, Channel Islands, West Indies, Venezuela, Brazil, Uruguay, and other countries. There is a steady market for Irish seed in most of these countries, but very keen competition has to be faced. Ireland has, however, natural advantages which few countries possess. Potato varieties retain their vigour almost indefinitely in this country, as witness Lumper (see Figure 75) a variety that was well-known in 1810 and was the variety grown by the poorer people at the time of the famine in 1845-46. Many other very old varieties still exist such as Pink Eyes, grown extensively in 1795, Cups, known soon after 1800, and Rocks, introduced about 1840. Coming down to more modern times the Champion, raised in 1863, is still grown on a commercial scale, and good vigorous stocks are procurable; Early Rose, introduced in 1867, is also grown commercially; Beauty of Hebron, introduced in 1878, is still vigorous on the Athlone bogs, while Sutton's Abundance (1886), Up-to-Date (1893) and British Queen (1894) are all apparently as vigorous as at the time of their introduction.

Why do stocks retain their vigour for such long periods in this country?

The writer's opinion is that this is chiefly, if not entirely, due to the **cool moist climate,** for the damper West Coast preserves vigour even better than does the drier East Coast. Whether this is the sole reason has yet to be established, but the fact remains that seed grown in this country gives highly satisfactory results wherever it is planted.

Every grower wants a sure market, a happy state of affairs that can be reached and maintained only by giving the buyer a reliable and satisfactory article. If British and Overseas buyers find that Irish seed gives a better yield and a more profitable

return than local seed, they will realize that they are well paid for their outlay, and so will repeat their orders. On the other hand, if buyers are not satisfied demand will soon cease.

The question then arises, how can the Irish grower make sure that his seed will always give the greatest satisfaction? The answer is by seeing that the growing crop is free, or nearly free, from all the injurious diseases described hereafter, and by having the seed dressed in accordance with the specified grade, and free from misshapen and damaged tubers. A consistently good article sold at a reasonable price will create and hold markets in all parts of the world.

Many difficulties have had to be overcome, the worst, of course, beng reluctance on the part of growers to change their methods, and prejudice against Irish seed on the part of buyers; but to use Carlyle's phrase "Prejudice now sits with sentence of death written upon his brow." The annual export of seed is now well over 10,000 tons, and much less difficulty should be experienced in the production and sale of an additional 10,000 tons each year.

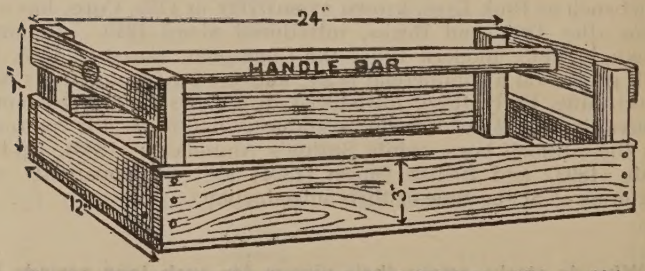

Fig. 2.—Suitable Box for Sprouting Seed Potatoes. (See p. 10.)

Most of the fundamental and wholesale improvements in the various arts of life are suggested, produced, perfected from without, resisted, deprecated, obstructed from within.
—*Gardener's Chronicle*, 1844.

SECTION I.—GROWING OF SEED POTATOES.

Seed potato growing is a specialist's job, and will become more so as knowledge advances and competition increases. If Irish growers are to hold what they have won and secure fresh markets, they must not relax, but always keep improving. The growing of the seed is the foundation on which the industry rests.

If the seed is properly grown, viz., free from disease, suitable size, etc., it is a comparatively easy matter to put up a first class sample for sale. Such a sample is always in demand, and usually pays the grower and pleases the purchaser.

This section deals with matters of importance in connection with the seed production, but it need not be thought that the advice given here or elsewhere can ever take the place of practical experience coupled with keen observation.

POTATO HOUSE.—A potato house is a great asset to any grower, but is a necessity to a seed grower who wishes to operate with any degree of freedom. If a grower wants to put up or pack potatoes for export, the law requires that his premises must first be registered for the purpose. Only premises that are suitable will be registered.

When a grower's premises are registered, he can sell his seed to any licensed exporter, can have the seed inspected and sealed on his premises, and can despatch it direct to any destination. A grower who has not registered premises can sell only to a licensed merchant who has registered premises in the vicinity. The seed must then be rehandled and repacked on the exporter's premises.

Again a grower who has a suitable potato house can remove a quantity of potatoes from the pits to the house any time the weather is favourable. The potatoes can then be dressed under cover whenever the buyer requires delivery. Opportunities to make sales are often missed because a grower is unable to give delivery during inclement weather. Wet potatoes are not inspected. In a house the potatoes can be dressed during bad weather when outdoor work is impossible.

Space for the storage of sprouting boxes is essential, and if no more suitable accommodation is available, a loft should be built to the potato house for this purpose. When this is done roof lights are a necessity, as good light must be provided for sprouting, otherwise the sprouts will be white and brittle and will be damaged during planting. The house should be dry, frost proof and rat proof, with a concrete floor, and provided with good lighting where the grader and skip are being operated. The floor space should be large enough to allow plenty of storage accommodation for the unselected potatoes and for the dressed seed, and space to work the grader, skip and weighbridge.

SPROUTING OF SEED.—Although growers are aware of the benefits of sprouting seed potatoes, the practice is not adopted to anything like the extent that is desirable. The time may come, however, when growing crops will be inspected only for those who sprout their seed and spray their crops. By sprouting the seed and spraying the crop, a reasonably good yield can be obtained every year. A long series of experiments conducted by the Department's Instructors showed that sprouting the seed increases the yield by from 30 cwts. to 2 tons per statute acre in an average season. Growers who have big yields in favourable seasons and few if any potatoes for sale in bad seasons are no help to the seed trade. A regular supply must be kept up so that those buyers who depend on Free State supplies will not be forced to buy elsewhere. From the seed growers' point of view, sprouting has the further advantage that "mixtures" or "rogues" can often be identified by the colour of their sprouts. (The colour of the sprout of each variety is given later.) If the boxes are kept in very bright light, the sprouts are so green that the purple or pink colour is often not noticeable, but under ordinary housing conditions no difficulty will be experienced. Again sprouting enables all diseased sets to be detected and removed. No set should be planted unless it has produced a good vigorous sprout. Diseased tubers can often be recognised by their sprouting prematurely.

Whole sets are recommended, but if the sets must be cut, the sprouted tuber should be cut very carefully part through, so as to leave the sets holding together. When planting the two or three sets, into which the tuber was divided, should be broken asunder and planted in succession. If the tuber should happen to be affected with any hereditary disease, all the affected plants are then together and can easily be located. It often happens that a tuber affected with a severe virus disease is cut into three sets, which are likely to be dropped far apart, so that the plants produced are more difficult to find when the crop is being rogued than if the three sets had been planted close together. The type of sprouting box recommended is shown in Figure 2. Boxes of the size illustrated will hold about 20 lbs. or 6 boxes to about 1 cwt. of seed.

Bates[1] and Weston recently investigated a very common trouble with sprouted potatoes. The tips of the sprouts often turn black and die without any apparent reason, but the decay does not spread further before the tuber is planted. Every possible cause for this trouble was considered, but no explanation was found. It was definitely not due to frost or injury, though the latter can bring about a somewhat similar condition. One striking fact observed was that the trouble never occurred with sprouts produced under good light, which were stout and short, tough in texture and crowned by a tuft of dark green leaves.

Boxes should always be turned from time to time, and those in the darker part of the loft brought nearer to the light.

---

[1]Bates, G. H., D.Sc., and M. A. R. Dillon Weston, Ph.D., "The Dying of the tips of Potato Sprouts during 'Chitting'." Scientific Horticulculture. Vol. IV., 1936.

SELECTION OF SEED.—A grower should be careful not to bring fresh seed on to his farm unless he is satisfied that it is from a good stock and will not introduce some disease that might be difficult or impossible to eradicate. The diseases that may be so introduced are shown in Section IV.

The merits of " cut " versus " whole " sets have been discussed for nearly two centuries. It is generally agreed that:—

(1) Cut sets produce larger tubers but in smaller numbers than whole sets.

(2) Whole sets are much less liable to miss than cut sets.

(3) Cutting of the sets encourages certain diseases, notably Black Leg.

When seed growers sell their seed-sized tubers, what is the best procedure to adopt for their own planting? Excellent seed can be secured by placing a man at the grader to pick off all the tubers that are slightly too large to pass through the riddle. The maximum size to be retained depends on the general run of the crop and the quantity of seed required. Such tubers will vary in size from 2″ or 2¼″ diameter upwards. These tubers should then be put into sprouting boxes and planted whole, 35 cwts. to 40 cwts. would be required to plant one statute acre. Except when potatoes are very dear, it pays a grower in this country who uses his own seed to plant this quantity, as the weight of the crop is always in some measure influenced by the weight of the seed planted.

Tubers of over 2 inches diameter if planted whole will produce a large percentage of small tubers, exactly what the seed grower wants. If such tubers are cut into two or three sets, the resultant crop will be chiefly a small number of large tubers, the very thing a seed grower does not require. Very small whole seed, unless planted very closely, will produce a small number of large tubers.

It is well to note that cut sets should never be kept in bags or put in heaps, as heating will follow and result in a much reduced yield.

VARIETY.—The greatest difficulty a grower has to contend with in the choice of varieties is that he must look twelve months ahead, as owing to varying conditions, the demand for the different varieties fluctuates considerably from year to year. Irish Free State seed has, however, gained so high a reputation that so long as the standard is maintained, a market can probably be obtained for whatever quantities are grown of the following varieties:—

EARLY VARIETIES.—Arran Pilot, Ninetyfold, Eclipse, May Queen, Duke of York, Sharpe's Express, Early Rose, Di Vernon, Epicure (limited quantities).

SECOND EARLIES.—Royal Kidney, Great Scot, British Queen, Catriona.

MAINCROP.—King Edward, Majestic, Up-to-Date, Arran Banner.

The most promising new varieties at present are:—

Earlies.—Doon Early.

Second Earlies.—Ulster Monarch, Dunbar Rover, Arran Signet.

Maincrop.—Gladstone, Red Skin, Dunbar Standard, Dunbar Archer, Arran Peak.

Particulars regarding these varieties are given later but a new variety requires to be some years in cultivation before it can be classed as a success or a failure. For instance, Doon Star did not attain popularity until seven years after its introduction.

SOIL.—Soil is a vital factor in the production of seed, because some soils are liable to produce an excessive amount of certain diseases, notably Common Scab and Powdery Scab. Experience alone can show which soils are suited for the production of the best seed, but the belief has long been held universally in Ireland that bog land produces the best seed. The same belief is held in certain other countries, notably Malta and Cyprus. Bogs are composed almost exclusively of partially decayed vegetable matter, and usually contain a superabundant supply of moisture which they absorb like a sponge.

Many early British writers recommend seed from mossy land. Dr. James Anderson, the most outstanding of all the earlier writers on the potato wrote in 1786:—

> "It has been said that potatoes which were taken up before they attained perfect maturity infallibly become affected with this disease (Curl); but in some cold mossy soils, and exposed situations, where the potatoes must often be taken up while they are yet in a state of vigorous vegetation the disease (Curl) is scarcely known."

Sir John Sinclair in 1828 wrote:—

> "It is a practice of the Lancashire planters to send some of their favourite kinds to the mossy grounds to recover, if they are found to have a tendency to Curl, and it is certain that potatoes from mossy land will not curl."

The Rev. William Hickey, an Irish writer, under the pseudonym "Martin Doyle" in 1839 says:—

> "The seed grown upon bog or moorland, though as wet as a sponge, has produced the most abundant crops and of a dry and mealy quality, too, on soil of a DIFFERENT composition; and though the careful Scotch farmer changes the seed of the potato frequently, it is remarkable that the grower on the moors and mosses continues to plant from his original stock without any change of seed. The nature of this potato, full of sap, is so well understood by the Scotch, that the supplying of the lowlands with seed from the moorland farmer has become a regular system, and to the advantage of both parties, the latter obtaining a much higher price for his watery seed than is obtained from the most farinaceous potatoes in the market, and without even the trouble of conveying them hither, the purchaser of the seed being at the expense of cartage—sometimes to a very CONSIDERABLE DISTANCE. The same practice prevails in Ireland; seed that has been grown on bogs—often planted so late as June and dug out in October—is always preferred for soils of a different quality from that in which the stock was raised."

This remark applies in 1937 as it did in 1839. Owens, another Irish writer, in 1843, says:—

> "The farmer should endeavour to have his potatoes for seed from moor or mountain soils, and if such cannot be procured, from mellow fresh ones, always avoiding seed from worn out land."

Many other references could be quoted, but the foregoing are sufficient to show that a very widespread belief has existed for at least 150 years that the best seed is obtained from bog or moorland. Only the results of experience can account for such a universal belief. The fact that varieties retain their vigour for a very long period when continuously grown on bog land is the best proof that such land is eminently suitable for the production of seed. No other type of land produces such vigorous foliage, though the actual yield on bog land is nothing abnormal.

In the Athlone district the annual output of seed from bog land varies from 2,000 tons to 2,500 tons. This seed has a wonderful reputation and has given good results in many countries. Bog land in other districts is being gradually worked up for seed potato production. Advantage should be taken by owners of light bog to grow varieties such as May Queen, that can be successfully cultivated for seed purposes only on specially suitable land.

Apart from bog land, any land which will produce a good clean skin is suitable for seed production, provided it is situated in a suitable district.

SITUATION.—It has been the general practice during many generations for growers in the neighbourhood of mountains to bring seed potatoes from the high ground to the low ground but never from the low to the high, if it could be avoided. In fact, there is more or less a universal belief that seed from a high altitude is superior to that grown on lower ground. Recent research lends a certain amount of support to this belief, because the chances are that virus diseases will be less prevalent in the higher altitudes for two reasons, viz., insects are usually fewer in number and as a rule smaller areas of potatoes are cultivated, with a corresponding reduction in the possible centres of infection, or in other words isolation is usually better in the higher ground. Altitude is certainly not a necessity for the production of healthy seed, as witness the bog lands at Athlone, which are not more than 200 feet above sea level.

The only research work that has been done which throws any light on the suitability or otherwise of certain districts for seed production was carried out by Maldwyn Davies in Wales. He found that the greenfly *Myzus persicae* which is mainly responsible for spreading the Leaf Roll Virus and Virus Y (Leaf Drop Streak) is sometimes found at high altitudes in Wales, and that in such places there is a considerable spread of the Virus diseases, while in some of the lower ground almost at sea level the greenfly is rare. Research of a similar nature is needed in this country. Davies also showed that *Myzus persicae* is very inactive under cool, moist or windy conditions and becomes very active in warm dry weather.

Experience and the research work so far carried out show that the best districts for production of vigorous seed are those that have a high rainfall, a cool moist climate and are exposed to wind. In consequence, it is easy to understand that vigorous seed can be produced along the whole western coast of Ireland from Donegal to Cork, where the breezes from the Atlantic almost perpetually blow, keeping the air cool and moist and supplying a rainfall varying between 50 and 100 inches, fairly uniformly distributed throughout the year.

Other factors must also be mentioned. No situation no matter how favourable can eliminate virus diseases from plants already affected, so that to produce good stocks, the foundation stocks must be free from virus disease.

Isolation is also a very important factor. Good seed grown in the vicinity of crops badly infected with virus disease is always liable to become infected.

Seed grown in high altitudes is likely to have better isolation, as less land is cultivated. Furthermore, in Ireland there is usually a higher rainfall and more wind at high than at low altitudes.

In short, the best situation for the production of vigorous seed is where the air is cool and moist, the rainfall high, over 50 inches, without any long dry spells, winds frequent and where good isolation from other potato crops can be obtained.

ROTATION.—A good rotation is a necessity to the seed potato grower. Every farmer worthy of the name recognizes the benefits of a rotation, but for the seed potato grower it has the further advantages that "groundkeepers" disappear, and so mixtures in the succeeding crop are avoided and, what is of paramount importance, many very serious diseases and pests are kept in check, such as:—Eelworm, Stalk Disease, Pink Rot, Watery Wound Rot, Stem Canker, Common Scab, Powdery Scab, Skin Spot, Wireworm, etc. As long a period as possible, certainly not less than four years and preferably much longer, should elapse between two successive potato crops. It is well to ensure, even if a rotation is followed, that when a field is in Root Crop, turnips or mangels, beet, etc., are grown where potatoes grew when the field was previously under Root Crop and vice versa. No crop is certified for seed purposes in which "groundkeepers" appear. These, as already mentioned, can be done away with by the adoption of a suitable rotation.

CULTIVATION.—The proper method of cultivation can be learned only by experience. A book could be written on the subject but might be of little help, so much depends on the soil and the weather. It is easy to cultivate properly when the weather is favourable. Having the seed sprouted is of great assistance in a late spring, as cultivation can then be delayed two, three or even four weeks without causing a serious reduction in the yield of the crop.

The object to be aimed at is to keep the ground open and loose and to have the cultivation completed before the growth of the plant is too far advanced. Late grubbing or moulding damages the root system.

Proper moulding, viz., getting plenty of earth up on the tubers, while it does not help the yield, is one of the best means of protecting the tubers from Blight. This disease reaches the tubers by the spores falling from the leaves and being washed through the soil to the tubers. The spores cannot pass through four inches deep of soil.

Crops not well cultivated will not be certified for seed purposes.

MANURING.—Every seed potato grower in this country should be well aware that the most economical artificial dressing to use is a mixture of Sulphate of Ammonia, Superphosphate and Muriate of Potash. The quantities per statute acre recommended by the Department of Agriculture are 1 cwt. Sulphate of Ammonia, 4 cwts. Superphosphate and 1 cwt. Muriate of Potash along with a medium dressing of farmyard manure. The quantity of manure that can be profitably applied will depend on other conditions to a considerable extent. If the cultivation is bad and if the crop is not sprayed, it is obvious that the maximum return will not be obtained from the manure. The seed grower, of course, does not want large tubers, but he does want the maximum yield of small-sized tubers. The size can be kept down by planting whole seed very close, and, if need be, by burning the tops.

It is an open question as to whether farmyard manure should or should not be used. Some growers think it increases the amount of disease, while others hold the opposite view. Unless diseased tubers or soil containing diseased tubers or portions of tubers from the potato house, etc., have been thrown into the manure heap, the application of a moderate dressing of farmyard manure is recommended. By ploughing down the manure in the autumn a very considerable amount of labour is saved in the busy spring months, but ton for ton application of the manure in the drills usually gives better results. Farmyard manure is not, however, a necessity, as quite satisfactory yields can be obtained by the use of artificial manure alone. When artificial manure alone is used, at least 2 cwts. Sulphate of Ammonia, 6 cwts. Superphosphate and 2 cwts. Muriate of Potash per statute acre should be applied. In certain circumstances the Ammonia can be increased to 3 cwts., with more profitable results. On bog land not more than 2 cwts. of Sulphate of Ammonia per statute acre should be used. Many growers make a great mistake in not using a potash manure. As Muriate of Potash is cheaper than Sulphate of Potash, the former is recommended. Here again it is well to remind growers that the time will soon come when those who are not prepared to manure their crops properly cannot have them inspected for seed purposes. The period for inspection is limited by the growth of the plant itself

to a few weeks between about 1st July and 21st August. The number of growers whose crops can be inspected is limited, and primary consideration will, of course, be given to those who attend to their crops in a satisfactory manner.

It is a very short-sighted policy to starve the crop. A starved beast or a starved crop never pays.

It has been proved beyond doubt that all the Sulphate of Ammonia should be applied at the time of planting, and not applied wholly or partly later as a top-dressing.

Superphosphate is decidedly the best source of phosphate for the potato crop. Basic Slag is not a success on potatoes.

Superphosphate and Sulphate of Ammonia applied without any potash manure cannot give a maximum return. There must be a sufficient supply of nitrogen, phosphates and potash to get the best return. The want of potash is often responsible for " Rust " in the crop, which seriously reduces the yield.

Manures recommended per statute acre.

	(1)	(2)
Farmyard Manure	15-20 tons.	No farmyard manure.
Sulphate of Ammonia	1 to 2 cwts.	2 to 3 cwts.
Superphosphate	4 cwts.	6 cwts.
Muriate of Potash	1 cwt.	2 cwts.

PLANTING.—A suitable width for drills is 26 inches, and only under exceptional conditions of soil is a greater width necessary. For the production of a large percentage of seed, the sets must be placed much closer than for ordinary crops. Six inches apart, except in the case of very large tubers, is space enough for seed production, and nine inches should be regarded as the maximum.

The time of planting depends, of course, on local conditions. Bogs should be planted last, as they are most liable to frost. If plants are badly frosted, they never recover completely, and produce a large proportion of mis-shapen tubers.

If cut sets are used, the tubers should be planted as soon as possible after cutting. When so treated they are least liable to miss. Dusting with lime, etc., is of no value.

When planting a field the labour should, if possible, be so arranged that the drills are opened, the manure applied, the sets planted and the drills closed without any delay. The plough should open a drill going in one direction and close a drill when coming back.

SPRAYING.—Potato Inspectors may at any time refuse to inspect crops that are not properly sprayed. The grower who neglects spraying is not wanted in the seed trade, as he will have no potatoes for sale in the scarce years, when they are most

required. To carry on the seed trade a steady supply from year to year is a necessity. Inspection of a crop is so much time wasted if it is, at a later stage, destroyed by Blight.

Spraying is an absolute preventative if done in time and sufficiently often, but growers should bear in mind that the disease is in the plant at least five days before any external symptoms are noticeable.

For the first and second sprayings 4 lbs. Copper Sulphate, 5 lbs. Washing Soda to 40 gallons water may be used, but for the third spraying 8 lbs. and 10 lbs. respectively should be used. The Department's Leaflet No. 14, giving full particulars regarding spraying, may be had free on application to the Secretary, Department of Agriculture, Dublin.

BURNING OR CUTTING OFF THE TOPS.—This practice should be adopted especially in the case of early varieties. The destruction of the tops, if done at the right time, is a great safeguard against Blight and keeps the tubers to the required size. Seed-sized tubers of such varieties as Ninetyfold, May Queen and Arran Pilot should be worth, even in times of bad prices, £5 per ton, whereas large over-sized tubers of these varieties are practically unsaleable.

Burning the tops has proved to be more convenient than cutting. In this country the burning has been done with 14 lbs Copper Sulphate in 40 gallons water, 80 to 120 gallons per acre of the solution being required. The burning is not always as complete as is desirable. On a sunny day the solution runs off the foliage, causing very little injury, but on a dull day when the foliage is damp, the solution is most effective, as it does not run off the foliage so readily. Some growers have found when using a horse machine that by applying about one-half the usual quantity of spray going in one direction, and then applying another light spraying coming in the opposite direction, the burning was much more effective. Those who remember spraying in its infancy in this country may recollect that the stalks were often burned on account of too little lime being used. It is just possible that if a *small* quantity, say 2 lbs., per barrel, of Washing Soda were mixed with the Copper Sulphate, the solution might stick better and prove more effective in burning. The experiment is worth trying.

In Great Britain and the Channel Islands Sulphuric Acid has been used in recent years for the burning of the tops. In 1936 10,500 acres were sprayed compared with 6,000 acres, in 1935. This increase in a substantial acreage goes to show that Sulphuric Acid must have been fairly satisfactory, but as the writer has had no personal experience of the Acid spray, he is not in a position to pass judgment upon it.

Sulphuric Acid kills all weeds, and probably kills all the spores of Blight with which it comes in contact. Its after-effects, if any, on the soil are not yet known. The drawbacks to its use in this country are that the ordinary spraying machine cannot be used for applying the Acid, but a special machine can

be obtained which will apply the ordinary spraying mixture and also can be used for the acid spray. Sulphuric Acid is also more troublesome to handle and must be used with great care.

The matter is still more or less in the experimental stage, and several Agricultural Colleges in Great Britain are conducting experiments regarding the use of the Acid. The National Sulphuric Acid Association, Ltd., 166 Piccadilly, London, W.1. supplied the following information:—

> "The strength of acid usually employed is 15%, that is, 15 gallons of B.O.V. (Brown Oil of Vitriol) per acre are generally diluted with 85 gallons of water, but in some cases diluted with less water, say 65 to 70 gallons, though still sprayed over the same area, namely, one statute acre. Occasionally 20% acid has been used, especially when the haulm was more luxuriant and the weather conditions wet or very moist. On the other hand, as low a strength as 7½% has proved quite satisfactory under ideal conditions of sun and drying wind."

Cutting the tops can be done successfully only by the use of the hook. A scythe cannot very well be used, as instead of cutting, it pulls many of the stalks with tubers attached to them. The cutting should be done as close to the soil as possible.

The cutting or burning should be done as soon as the tubers have reached a sufficient size for seed. The crop should be tested by lifting a few stalks in different parts of the field. As soon as the tubers are sufficiently large, the burning should not be delayed, as the tubers usually swell an appreciable amount after the burning or cutting.

If Blight makes its appearance, the operation of cutting or burning should be rushed, as if the tops are destroyed in time, the disease will not reach the tubers.

Growers of seed potatoes, especially of early varieties, or any varieties on bog land, should not allow another season to pass without testing the results of destroying the tops on at least portion of the crop. They will find that it is a paying proposition.

DIGGING.—Potatoes should not be dug until at least two weeks have elapsed after the foliage has completely withered naturally, or has been destroyed by burning. If tubers are dug while the foliage is still partly green, and if, as is likely, any Blight is about, the tubers are practically certain to become affected, and to go bad in due course.

The greatest care must be exercised in the digging of potatoes for seed purposes for early shipment. Potato Inspectors will not examine tubers dug early, unless they are satisfied that special precautions for the destruction of the tops were taken two weeks prior to digging.

Every grower is aware that potatoes should, if at all possible, be lifted under dry conditions.

Potatoes are raised with a fork or spade, with a plough or with a mechanical digger. In proper hands the fork or spade makes the best job, as it gets the tubers all out of the ground

and causes little damage to them. The plough in proper hands is also satisfactory, as it causes little damage. The mechanical digger can only be regarded as a necessary evil, as it always injures the tubers, especially the larger tubers. If the larger tubers are closely examined, it will be found that scarcely one escapes injury, and thus a means is provided for the entrance of several diseases, more especially Dry Rot. Some growers have found that by putting rubber tubing or cloth binding on the prongs of the digger the number of damaged tubers is reduced.

More care also is necessary in the gathering of the tubers. In some cases they are thrown into baskets yards away.

It cannot be too often emphasised that seed potatoes must be treated as if they were eggs and not as if they were stones.

Even when every precaution is taken, the tubers are still liable to damage, but if Potato Inspectors see any cases of wilful damage or damage due to carelessness, they will not allow the seed to be exported.

PITTING OR HOUSING.—If at all possible seed growers should separate the seed tubers from the ware before storing. There is often a good demand for seed at a time when there is no demand for ware, or vice versa; at such times it is a great convenience, as regards saving labour and abuse of the tubers, to have seed and ware stored separately.

Every seed grower should have a house capable of holding at least ten tons of potatoes, where they can be dressed during bad weather. It frequently happens that a merchant wants quick delivery, and in such circumstances a grower who has no house often misses his market.

Potatoes keep fresher in pits, and as a rule it is advisable to store only a comparatively small quantity in the house. When these are sold a fresh supply can be taken in at the first favourable opportunity. Precautions must always be taken not to allow potatoes intended for ware to be long exposed to light, as such exposure renders them unusable.

There is very considerable difference of opinion as to how and where a pit should be made. Some growers make pits scattered over the field in positions convenient for the gatherers to empty their baskets. Other growers place carts in a line parallel with the potato drills, and the gatherers empty their baskets into the carts, which are then emptied either in a shed or into a pit. In this case pits should be made on dry ground near a road.

Pits in this country are advisedly made narrow, the base being 3 to 4 feet wide, with the sides sloping to a point 2½ to 3 feet high. In some parts of the country nothing but the soil is used as a covering. Growers contend that by using soil only as a covering fewer tubers become affected with Dry Rot. The objection to this method of covering the pits is that unless they are opened in very dry weather the tubers come out very wet and dirty, and must be left to dry in a shed before they can be exported, as wet potatoes will not be inspected for export. In some districts pits are so well made that the potatoes come out nearly as dry as out

of a house. These pits are covered first with a thin layer of rushes. Rushes are found to be superior to straw of any kind, as they rot much more slowly. If rushes are not available withered grass, etc., hedge or ditch cleanings may be used. If nothing but straw is available, wheat or rye straw is preferable to oat straw; barley straw is almost useless. On top of the rushes a thin covering, about 6 inches of soil is placed, and on top of the soil a thin coating of rushes, held in position by a few sods or shovels of earth, to run off the rain.

In some districts pits are very carelessly made. Potatoes are left lying for days with only a covering of withered stalks and weeds from the potato field. Potato Inspectors have special instructions not to examine such potatoes when being sold as ware. "Greening" does not injure seed, but to cover the tubers with old potato stalks is to invite trouble.

For perfection, though it ought to be aimed at, can never be attained.—G. S. Keith, 1811.

SECTION II.—INSPECTION OF GROWING CROPS FOR SEED PURPOSES.

CONDITIONS OF CERTIFICATION.

The following conditions laid down for the certification of growing crops apply to the whole crop of any variety:—

(1) The crop must be vigorous and well cultivated.

(2) The crop must be pure and true to name.

(3) The whole field must be free from the following virus diseases:—Leaf Roll, Crinkle, Leaf Drop Streak, Top Necrosis and Foliar Necrosis.

(4) The crop must be free from plants affected with Mosaic Disease, which is obviously causing a reduction in their yielding capacity.

(5) The crop must be free from Black Leg.

(6) "Rogues" must be dug out, not pulled. Where an inspector finds that a "rogue" has been pulled and the tubers left in the ground, the crop will not be certified.

(7) A crop in which "groundkeepers" appear cannot be certified.

(8) A special "Health" certificate will be granted only for a crop the produce of "Health Stock" seed and grown in a good seed district not less than 100 yards from other potatoes. Such a crop must be completely free from virus disease and from Black Leg.

(9) Save under exceptional circumstances, crops will not be certified where more than *four* varieties are grown by the same owner. In all cases where more than one variety is grown, the varieties planted must be chosen from different groups as shown below. If two or more varieties from the same group are grown on the same farm, a certificate cannot be granted.

GROUPS.

(a) Di Vernon, Catriona.
(b) Early Rose, Beauty of Hebron.
(c) Duke of York.
(d) Epicure, Arran Crest, Doon Early.
(e) May Queen, Sharpe's Express, Eclipse, Ninetyfold, Arran Pilot.
(f) Great Scot, Arran Banner.
(g) Up-to-date, Field Marshal, President, Arran Cairn.
(h) British Queen, Majestic, Abundance, Puritan, Ballydoon, Ulster Monarch, Dunbar Rover.
(i) King Edward, Gladstone.
(j) Golden Wonder, Langworthy.
(k) Champion, Invincible.
(l) Kerr's Pink, Irish Queen, Red Skin.

(10) Where two or more varieties are grown in the same field, a division of not less than 9 (nine) feet in width, in which any crop other than potatoes may be planted, must be left between the varieties, see Figure 3. Where spade labour only is employed, a division of 2½ feet between two varieties will suffice.

TIME OF INSPECTION.—Growers must have their crops ready for inspection at any time between 1st July and 21st August.

GROWERS' DUTIES—Farmers who have been accustomed to grow table potatoes should not delude themselves by thinking that seed potatoes can be grown in any haphazard fashion. Those who undertake to grow seed must give the crop more than ordinary attention. It is for the grower to see that his crop complies with the conditions set out above. If he desires further information he should apply to the local Potato Inspector.

Crops will not be certified for seed if they are grown in the same field with potatoes of a nondescript character.

Crops cannot be inspected in districts where no potato Inspector is operating.

POTATO INSPECTOR'S DUTIES IN CONNECTION WITH GROWING CROPS.

The Inspector's duties are confined to examining the growing crops and deciding whether they comply with the conditions required for certification for seed purposes. A numbered certificate is issued by the Department in respect of each crop passed by the Inspector.

In the case of a crop not up to the required standard of purity, health, etc., but containing less than 0.5 per cent. of undesirable plants, the Inspector may at his own discretion, if the grower provides sufficient assistance, point out the plants that must be removed to bring the crop up to the required standard. Such plants must be removed while the Inspector is present.

Where a proper division has not been left between two varieties, growing in the same field, the crop will not be inspected.

If an Inspector finds a plant affected with Leaf Roll in any part of the field, the whole field must be rejected.

The acreage that an Inspector can certify in a season depends on the area of the potato plots, the density of the potato acreage, the varieties grown, the condition of the crops, and the number of plants that have to be removed, etc. The maximum acreage that can be certified is 500 acres, but up to the present not more than 300 acres could, as a rule, be covered by one Inspector. Good uniform crops will be inspected in preference to neglected crops.

It is a certain Market that makes the Husbandman industrious. The reward must equal his Toil.
—George Rye, Ryecourt, Cork, 1730.

SECTION III.—MARKETING.

SECURING A MARKET. - All efforts must be directed towards securing a market and retaining it. Many countries must buy seed potatoes and these countries will buy the best article if the price is not too high. When a good reputation has once been firmly established competition amongst buyers automatically increases the price. A good name takes long to acquire but may be quickly lost through carelessness or faulty methods. The reputation of Irish Free State seed now stands high in importing countries and everything must be done to keep the quality of the seed above criticism.

AGRICULTURAL PRODUCE (POTATOES) ACT, 1931.—This Act came into operation early in 1932. The main provisions concerning the Seed Potato Trade (including growers, licensed exporters and inspectors) are:—

(1) Potatoes intended for export must be packed in registered premises which may be the property of a merchant or a grower.

(2) The following are among the conditions of registration:
   (a) The premises must be suitable, viz.:—sufficiently large, properly lighted, frost proof, rat proof, provided with good flooring, etc.
   (b) Proper equipment must be provided, viz.:—grader, skip, weighbridge.
   (c) A qualified person must be in charge of the premises.

(3) Only a licensed person or firm can export potatoes.

Fig. 3.—Field showing division—4 drills turnips between two varieties of potatoes. (See p. 21.)

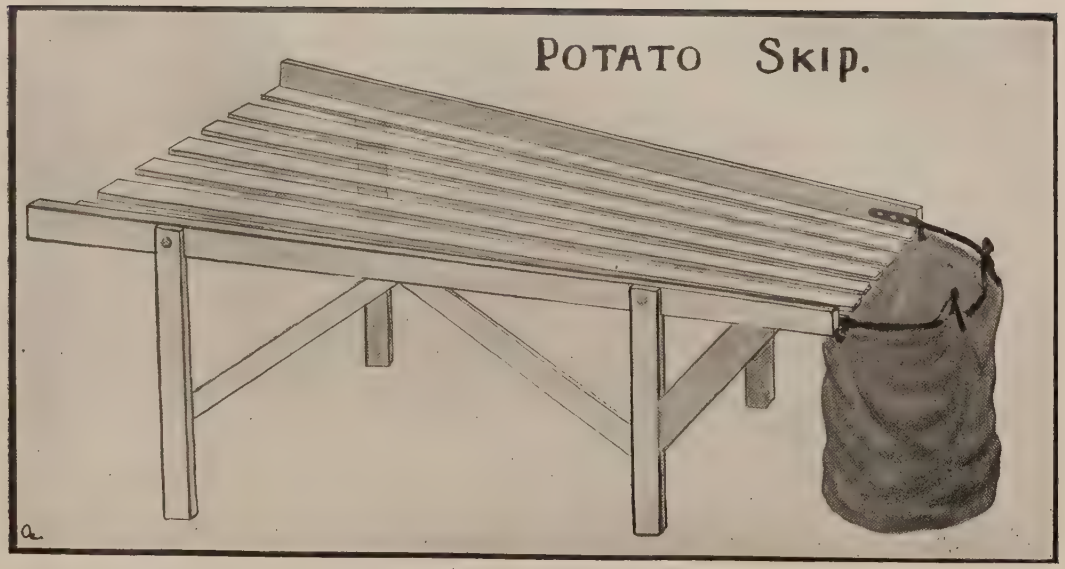

Fig. 4.—Potato Skip for convenience of removal of diseased, damaged and mis-shapen tubers. (See p. 24.)

(4) Regulations are made governing the grading and packing of potatoes including the method of grading, the condition of the potatoes, the quality of the potatoes and the type of sacks to be used.

These regulations require that all seed potatoes except certain specified soft early varieties *must be passed over a grader*. The riddles of the grader should be rubber-covered to prevent damage to the tubers. Riddles which are not strictly accurate cannot be used.

A consignment in which the tubers do not conform to the specified grade, which must be branded on the sack, will not be passed for export.

Potatoes must be dry, reasonably clean, and free from diseased, damaged, mis-shapen tubers and tubers bearing sprouts.

Seed potatoes must be put up in strong, clean sacks which have the seams sewn with a twine or string, not with a fine cotton thread which is always liable to break, especially if the bags become damp. Particulars regarding sacks are given later in this section.

(5) The requirements as to branding of sacks are dealt with later.

(6) Regulations also provide for the protection of potatoes during transit. Vehicles used for the conveyance of potatoes must be clean and dry and sufficient covering must be provided to protect the potatoes from frost and rain.

Loading and unloading must be conducted in such a manner as to prevent damage to the potatoes or the sacks. Canvas slings and not rope slings must be used. Walking on sacks filled with potatoes constitutes an offence under the Act. Inspectors have strict instructions to remove the seals from any bags that are walked on or otherwise abused and to insist on the contents being redressed.

(7) If on examination an Inspector is satisfied that seed potatoes are the produce of a certified crop and that the consignment fulfils the other requirements of the Act he will put an official seal on each sack. This matter is dealt with more fully later.

GRADER.—The Act provides that all seed potatoes sold for export must be passed over a grader with the exception of certain specified soft early varieties. This is necessary to ensure that consignments will be of the exact standard of grading required. If on inspection oversized tubers are found in a sack, the consignment must be rehandled.

When ordinary riddles have been in use for some time it is found that the wires are apt to shift thus allowing oversized tubers to pass through. To get over this difficulty the regulations require that the wires of top riddles must be welded

wherever they cross so that they cannot move. Quite recently a firm of manufacturers put rubber-covered riddles on the market. These cause much less damage to the tubers and no other riddles should be used. The rubber covering wears very well. Information regarding types of graders can be had on application to the Secretary, Department of Agriculture, Dublin.

POTATO SKIP.—Figure 4 is an illustration of a potato skip, a raised sloping platform on which potatoes can be properly selected. No picker can do good work if he is compelled to carry on for long hours in an unnatural position either bent double or on his knees. With the aid of a skip a picker can stand erect, and have the potatoes at a convenient height to see all faults. While the potatoes are being rolled down the wooden bars, every diseased, damaged, or mis-shapen tuber can readily be seen. A responsible person should always be picking close to the mouth of the sack, to remove any undesirable tuber that had previously escaped detection; otherwise rejections will be frequent.

Potatoes should first be put over the grader to remove all undersized and oversized tubers, and then put over the skip to have every diseased, damaged or mis-shapen tuber removed. A bag containing some hay must be placed under the potato sack to save from injury the tubers that drop first into the sack, and also to keep the sack clean.

There are no exact dimensions required for such a Skip, except that the end where the sack is hung should be raised from the ground the height of a 1 cwt. sack filled with potatoes, viz.: not more than 2′ 11″. The sack containing the potatoes must rest on the ground and not have its weight hanging on the hooks.

The following are the dimensions of the Skip illustrated:—

Back Legs 4′ 0″ high. Timber (larch) 3″×3″ (check cut on top to carry crossbar and sides).

Front Legs 3′ 4″ high. Timber 3″×3″ do.

4 side braces from legs to sides 4′×5″×$\frac{3}{4}$″. From centre of legs to centre of sides, nailed inside.

Cross brace on back legs 2′ 8″×4$\frac{1}{2}$″×$\frac{3}{4}$″. Set on 1′ 2″ up from ground

do. front legs 2′ 0″×4$\frac{1}{2}$″×$\frac{3}{4}$″. do.

Cross-bars carrying platform { Back are 2′ 5″×4$\frac{1}{2}$″×1″ / Centre 2′ $\frac{1}{2}$″×4$\frac{1}{2}$″×1″ / Front 1′ 8″×4$\frac{1}{2}$″×1″

Back and front, counter sunk, or checked into legs to depth of 1$\frac{3}{4}$″; centre nailed to sides.

Platform { Total length 9′ 1$\frac{1}{2}$″ / Width at back 2′ 7$\frac{1}{2}$″ / Width at front 1′ 7″ } 4 bolts, 3$\frac{1}{2}$″×$\frac{3}{8}$″ required for bolting legs to platform sides.

Timber used in platform—2 sides 9′ 1$\frac{1}{2}$″×4$\frac{1}{2}$″×1$\frac{1}{2}$″

Laths, 7 required, 9′ 1$\frac{1}{2}$″ long, 3″ wide at back and planed down to 1$\frac{3}{8}$″ in front. These laths are nailed on to the crossbars, with a space of 1″ between the laths.

OTHER FITTINGS.—Circular iron rod ⅜", with ends flattened and pierced for screws to hold to the front end of sides, as illustrated. A hook fastened on each side to catch the sack and a spring clip to hold the outside edge of the sack to the iron rod. The rod is set on in bow-shape, and is 10" from end of boards at centre.

SACKS.—The Regulations provide that sacks " shall be clean, sound and sufficiently strong in the opinion of the Inspector to hold the potatoes contained therein intact to their final destination." Cost is always a serious consideration, as the price of potatoes will not allow for the use of an expensive sack. Up to the present no sack has been found to compare in price and quality with the Australian twill sack which is primarily used for the transport of wheat from Australia. Owing to the increasing use of suction plants for the unloading of wheat these sacks are not coming over in the same quantities as formerly, but so far sufficient supplies have been available. One of these sacks well branded, sewn and sealed is shown in Figure 5. A sound, clean, well-branded sack is a great advertisement wherever it goes. Buyers cannot fail to be impressed by its appearance.

The Australian twill sack is so close in texture that the soil from the tubers does not work out through the cloth during transit. In consequence the sack arrives at its destination clean, and with the branding distinct and clear. Lighter and more open cloth allows the soil and especially bog soil to work through, so that the outside of the sack soon looks very dirty and the branding becomes almost illegible. The heavy cloth in the Australian twill sack is also a great protection to the tubers during transit.

The most important marks that must be distinct and clear on every sack offered for sealing are:—

(a) the name of the district or county in which the potatoes were grown (the name " Athlone " is reserved under the Act for bog seed only)

(b) the name of the variety

(c) the certificate number of the grower

(d) the grade.

(e) the exporter's initials.

Under Section 20 of the Act, markings other than those prescribed are prohibited.

Special marks required by foreign importers are allowable.

The name of the district should stand out boldly in 4-inch letters, the name of the variety, the certificate number of the grower and the grade should be in 3-inch letters, and the exporter's initials in 4-inch letters.

A standard type of branding should be used on all sacks so that wherever they go they will be an advertisement for the

district where the seed grew. In this way the names Donegal, Galway, Athlone, etc., should be known in many countries of the world.

When the grower's certificate number cannot be branded on the sack owing to the short time available to get ready a consignment for foreign shipment, the number must be clearly written or stamped on a plain label which should be attached near the middle of the top of the sack, not near the " lug " where it is likely to be pulled off. A plain label must be used, with nothing but the grower's certificate number on it.

No sack may be sealed unless the grower's certificate number is clearly branded on the sack or clearly marked on a plain label.

DIMENSIONS OF SACKS.—A sack to hold 112 lbs. net of potatoes must be not less than 23 inches wide by 39 inches long or 22 inches wide by 41 inches long.

SEWING OF SACKS.—Sacks must be sewn with strong twine, preferably binder twine. A packing needle about 7 inches long with a large eye is required and a piece of twine about 9 feet in length. The sewing must be done in the following manner:—the twine is doubled, and the two loose ends pushed about 4-6 inches through the eye of the needle. The spare cloth at the top of the sack is then rolled up compactly, and the needle passed through the cloth about ½ inch from the right hand outside edge of the sack and near to the rolled up cloth. The needle is next put through the loop formed by the doubled twine and pulled tight making a secure first stitch as a start for the sewing. (This is a much better method of making a good stitch to start with than by depending on a knot at the end of the twine.) The twine is then twisted tightly round about 3 inches of the cloth at the corner of the sack, and the needle passed through the double cloth about one inch from the first stitch, thus the " lug " is formed. Stitches about two inches wide are then made across the mouth of the sack—the needle being readily inserted below the roll of cloth—until only about 3 inches of the mouth is left unsewn at the left hand corner. The twine is then twisted round this piece of cloth to form the left hand lug, the needle passed through the cloth and pulled tight. Two or three wide stitches are then taken to bring the twine back to the middle of the top of the sack, the needle is then taken off, the twine knotted as close to the sack as possible, and the loose ends cut to within about 4 (four) inches from the sack. The official seal is then attached to the two loose ends.

SEALING OF SACKS.—Under Section 24 of the Act all sacks must be sealed with an official red seal, see Figure 6 before they are exported.

It is an offence for any merchant to export seed except in sealed sacks, and it is an offence for any public carrier to accept seed intended for export unless each sack is sealed and the potatoes accompanied by a Consignment Certificate. It is also an offence for any unauthorised person to have seals in his possession.

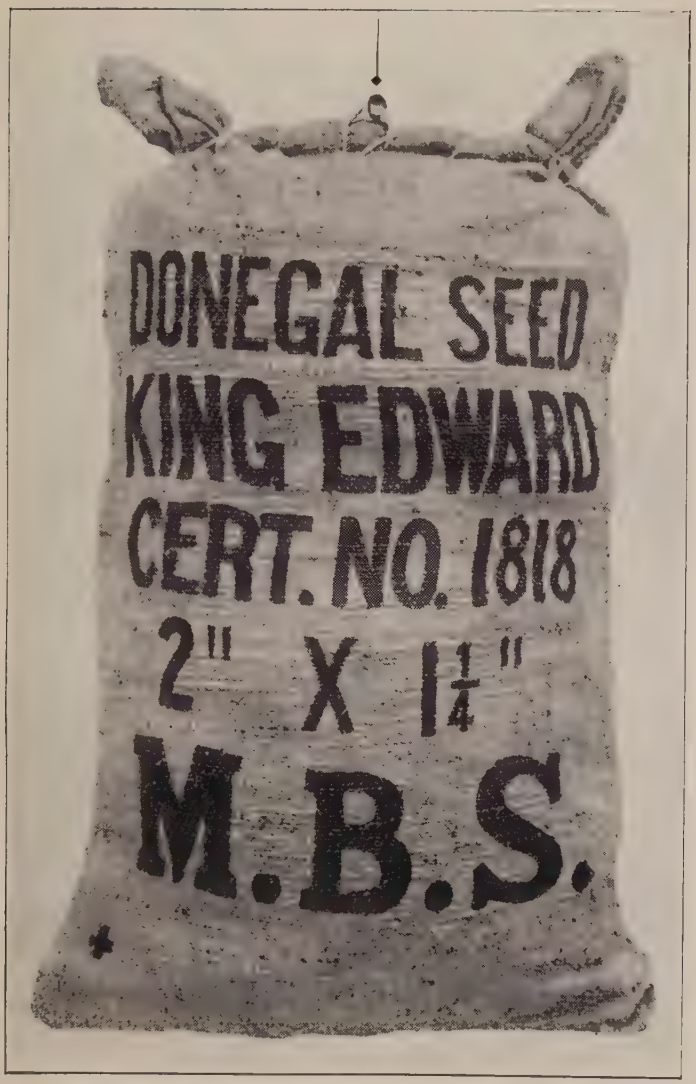

Fig. 5.—Sack sealed ready for shipment. (See p. 25.)

Fig. 6.—Official Seal for potato sacks, showing obverse and reverse.

DEPARTMENT OF AGRICULTURE, DUBLIN.

Irish Free State Seed Potatoes.

These potatoes are suitable for seed purposes, being the produce of a crop certified pure, free from Leaf Roll and all forms of severe Mosaic diseases. The tubers have been inspected for size and soundness by an officer of the Department and the bags sealed by him. The name of the variety and the grower's certificate number are branded on each sack.

(1421) M.4103. Wt.2281. D.Pr119. 180,000—10-35—F.P.—G.21.

Fig. 7.—Official Slip which is placed loose in the top of each sack. (See p. 27)

Purchasers of seed potatoes should always make sure for their own protection that each sack bears the official seal, marked (obverse) "Department of Agriculture, Dublin," and (reverse) "Certified Seed."

Many buyers now refuse to purchase seed except in sealed sacks, and in consequence the seal has been copied in some other countries, omitting, of course, the official title of this Department. The seal is the guarantee of quality, and if any purchaser has genuine cause for complaint he should immediately report the matter to the Secretary, Department of Agriculture, Dublin, when the case will be investigated. The grower's certificate number branded on the sack, or written on the label, should always be quoted so that the sack can be traced to its source.

SLIPS FOR INSERTION IN SACKS.—A slip as illustrated in Figure 7 is enclosed loose in the mouth of each sack, so as to make sure that each buyer is made aware that he is being supplied with Irish Free State seed. Slips have been printed in French and Spanish as well as in English. The Department has such confidence in the quality of the seed as to take this method of informing the user of the seed of its origin. The only objection to these slips is that they may be illegally transferred. Here again purchasers of Irish Free State seed in sacks bearing the official seal are invited, if they have any genuine cause for complaint, to communicate immediately with the Secretary, Department of Agriculture, Dublin, quoting the grower's certificate number.

WOODEN PACKING CASES.—Wooden packing cases must be used instead of sacks when seed potatoes are sent to South Africa and other distant markets. The case has the advantages of affording much greater protection to the seed, and of allowing much freer ventilation. A suitable case must be light and strong and made to provide free ventilation. Fresh timber should never be used. No standard case has as yet been specified, but a suitable type is of the following dimensions for 112 lbs. net of potatoes:—24½ inches by 15 inches by 15 inches deep with a wooden partition across the centre. This partition, which should not be made of one piece, is a necessity for safe travelling, otherwise there is too much pressure on the lower tubers. The ends of the case should not be made of one piece of timber, as is sometimes done, as it is very liable to split, and prevents free ventilation. Intending exporters should note that several severe losses have been incurred on account of cases not being made sufficiently strong, and through not providing sufficient ventilation.

TIME TO SELL.—Every grower must, of course, decide for himself when he ought to sell. Unfortunately many growers allow themselves to be guided solely by what happened in the previous season, and will not attempt to stretch their memories back to what happened the year before the last, and the year before that again.

"Prices rose last Jaunary and I will hold till next January." Such logic has left many growers with their potatoes on hands but without their money. The time to sell is when the buyer wants to buy, at least it is then possible to make a bargain. There is no use attempting to sell when buyers have purchased their requirements elsewhere. A buyer of seed potatoes requires only a certain amount. When he has bought this amount no offers, no matter how low, are of any interest to him. The writer has always recommended growers to accept for part of their crop, the first reasonable offer they get. A grower who has 10 tons for sale can afford to hold stiff for a price once he has 5 tons sold.

Many buyers must make their purchases early, possibly before the crop in this country is half grown. If they cannot get supplies here they go elsewhere and often do not come back. Some growers this Spring (1937) refused £8 per ton for Sharpe's Express, and were pleased to accept half the price later. Portion of the crop should always be sold early; if there are prospects of a heavy crop sell all as quickly as possible, but in times of scarcity a rise in prices may be expected, though the rise does not always come.

GROWER'S MARKETING DUTIES.—As already remarked every grower should sell part of his crop early. When making a sale, a Sale Note should always be procured, as the contract is then binding on both parties. The Sale Note should be carefully read.

In many cases it is more convenient for the grower, as well as for the merchant, to have the potatoes inspected and the sacks sealed on the grower's premises, so that they can be taken direct to the train or boat.

Before a grower can pack potatoes for inspection on his premises he must have the premises registered in compliance with the Act.

For registration the premises must be structurally suitable for the grading of potatoes, i.e., sufficiently large and dry with good flooring, well lighted (at least the portion where the grading is done) and rat proof. A satisfactory grader, a potato skip and a sack weighbridge must be provided.

An immense amount of trouble, delay and expense can be avoided by adopting a proper system of working. The tubers should be dry before grading is begun.

After being passed over the grader which removes small and over-sized tubers the seed should be carefully picked on the moving table of the grader. Each sack should then be carefully emptied on to the skip for the removal of all diseased, damaged and mis-shapen tubers that were not detected when passing over the grader. A reliable person should be placed at the end of the skip to see every tuber going into the sacks for export. Unless the potatoes have been very carefully hand picked before they are put on the grader, it is almost impossible, by one run over the grader, to leave the sample in a condition that will pass inspection.

The Act demands that consignments shall be free from diseased, damaged, mis-shapen tubers and tubers bearing sprouts.

It is most important that the same person should remain at the skip all the time, there will then be no reason why the contents of all sacks should not be equally good.

The sacks must be kept clean and dry, and must be properly covered during transit in wet weather. The sacks must be sewn in the manner previously recommended.

A grower whose premises are not registered must bring his seed potatoes in sacks to a licensed exporter's registered premises. Each sack must bear a label showing the name of the variety (unless such name is branded on the sack) and the grower's certificate number. Sacks not so labelled will not be inspected and should not be admitted to registered premises. The potatoes and sacks must be delivered in dry condition.

A grower who offers for sale uncertified seed as certified seed, whether his own property or not, or makes any improper use of the seed certificate granted to him will thereafter be excluded from the Seed Certification Scheme.

FUNCTIONS OF LICENSED EXPORTERS.—Legislation alone will not create a new industry or expand an existing one. The fullest co-operation from licensed exporters is necessary to secure the improvement and expansion of the seed potato trade.

A merchant must be licensed under the Act before he can become an exporter of seed potatoes. Consignments are inspected, and sacks sealed, only on behalf of licensed exporters.

A licensed exporter's functions fall into three categories:—

1. Marketing of seed.
2. Grading and selection of seed.
3. Improvement in seed production.

1. MARKETING OF SEED.—The value of an enterprising merchant to a potato-producing district, and more especially to a seed-growing district, is often not fully appreciated, nor does he always receive the active support from growers to which he is entitled. Without such a person the trade is dull and lagging.

The following suggestions for the improvement of marketing have been brought to the notice of the writer by individuals interested in Irish Free State seed:—

(a) Inquiries for seed should be immediately attended to and a reply sent as soon as possible, even if the licensed exporter has no seed to offer.

(b) Regular customers should receive first consideration, and be given every possible encouragement. It is a hopeless policy to rely on new customers each year. In many instances new buyers have been supplied with their full requirements, while regular buyers had to go short.

(c) The value of personal contact with buyers is often overlooked. Visits to such exhibitions as the Smithfield Fat Stock Show are among the best ways of keeping in touch with buyers.

(d) More use should be made of trade papers, etc., to keep in close touch with markets. It is difficult for merchants in this country to keep in touch with markets, and to know for instance what the demand for seed is likely to be, what varieties are likely to be scarce, and what are likely to be plentiful, what the current monetary value of seed is, etc.

(e) Improvements can be made by the use of standard sacks and by more care in transit. An exporter must have a responsible agent present at the loading of a cargo, and on all other important occasions.

2. GRADING AND SELECTION OF SEED.—In districts where growers have not got registered premises, the licensed exporter must have a registered store at which the seed from certified crops can be delivered. As previously indicated the premises must be sufficiently large and otherwise suitable, and must be in charge of a qualified person. The man in charge of the store is responsible for seeing that certified seed only is taken into the store, and that each sack of seed brought into the store has the name of the variety and the grower's certificate number either branded on the sack or on a label attached thereto. He must see the contents of each sack put over the grader, and when necessary also put over the skip, and the seed repacked into clean sacks that comply with the requirements of the Act. No potatoes can be taken into, or leave the premises except under the supervision of the person in charge. The storeman must accept full responsibility for all that leaves the store in sealed sacks.

3. IMPROVEMENT IN SEED PRODUCTION.—Some merchants helped to establish the seed-growing industry in their districts by introducing certified seed. In some cases an equal money's worth of ware potatoes was taken in exchange for the seed. This work is deserving of the fullest support.

Exporters should be in a position to advise growers as to what varieties are likely to be in demand.

Very large quantities of seed are grown in some districts on contract. This method has the advantage of guaranteeing a market but it is only to be expected that a merchant buying in advance can offer only what he regards as a safe price.

POTATO INSPECTOR'S MARKETING DUTIES—The Inspectors will give all the assistance they can in the marketing of seed potatoes. They will discuss with growers what are likely to be the most profitable varieties to plant, though the exporter ought to be best able to give this advice. Growers must, of course, bear in mind that no person can always correctly forecast what will happen in the potato trade several months ahead. Anyone who could do so, would soon become wealthy. Nothing more than an intelligent opinion can be given.

The Inspectors will also inform growers where suitable seed can be obtained.

As soon as the growing crops are examined an Inspector can give to any exporter interested, the acreage of each variety certified in his district and can make a fairly accurate estimate of the total quantity of seed of each variety that is likely to be available.

Before putting the official seal on a sack containing seed potatoes an Inspector must satisfy himself that:—

(1) the sack itself complies with the requirements of the Act, as already set out,

(2) the seed is the produce of a certified crop,

(3) the seed is graded to the standard branded on the sack,

(4) the consignment is free from damaged and mis-shapen tubers, and free from all injurious diseases.

(5) the sack contains 112 lbs. net of potatoes or whatever weight is specified.

An Inspector must not examine or seal seed potatoes that were grown outside his own district unless the owner produces a note from the Inspector in whose district the potatoes are grown. This note should state that the potatoes are the produce of a certified crop, and it can only be given when the potatoes are actually leaving the owner's premises. It is not compulsory on the Inspector receiving the note to act on it.

The Inspector should see that there is a good supply of riddles available in his district, and that only accurate riddles are used.

The more we learn, the wider does the path open out, so that we see ever more before us.—E. Hawks, 1928.

SECTION IV.—POTATO DISEASES.

This section treats of potato diseases and pests only in so far as they affect the seed potato grower. Fuller information can be found in articles which have appeared in the Journal of the Department of Agriculture and in the portfolio of leaflets published by the Ministry of Agriculture and Fisheries, London, under the title Collected Leaflets No. 3, Diseases of Potatoes.

Knowledge regarding potato diseases other than Blight was scanty until research was begun by Pethybridge and his colleagues in this country in 1909. Their work was continued for 10 years and received world-wide recognition. Many of the illustrations and much of the printed matter in this section are taken from Pethybridge's reports which were published in the Department's Journal between 1910 and 1919. The writer, and indeed the reader too, is further indebted to Dr. Pethybridge for much information generously offered and for assistance given in the preparation of these notes so that they might be made as complete as possible.

The work done by Murphy and McKay in recent years on virus diseases has proved of the greatest practical value to seed potato growers in enabling them to recognise the serious nature of these

diseases, and to clear out all inferior stocks. Research on these diseases is still in progress at the Albert Agricultural College, and several useful papers have been published by Clinch and Loughnane. Kenneth Smith's work *Recent Advances in the Study of Plant Viruses* was found very helpful. Assistance received from other sources is acknowledged in due course.

Seed potato growers should be conversant with the various diseases and pests that attack the potato crop, and make full use of every means of combating them. Ireland is free from two of the worst pests that ever attacked the potato crop, the Colorado Beetle and the Potato Tuber Moth. Eelworm, another dreadful scourge, is still well in hand, and has made trouble only in a few sandy districts where seed potatoes are never grown. The position regarding diseases and pests is probably more favourable in this country than in any other, and for that reason every precaution should be taken to prevent their spread and to eliminate them wherever possible.

A.—DISEASES WHICH APPEAR ON THE FOLIAGE.

BLIGHT.

This is the most destructive disease that affects the potato crop. It made its first effective appearance in Ireland in 1845, in September,[1] but was certainly in Kent and probably in Ayrshire in 1844. The earliest record of the Blight in England is a letter[2] written to The Right Hon. Sir James Graham, Home Secretary, by Robert Parker, a large potato grower in Kent. The letter is dated August 11th, 1845, and at that date the Blight had swept over a large part of England; but it does not appear to have caused damage in Ireland before September. All writers agree that the loss due to Blight in Ireland in 1845 was not very severe. Earlies and second earlies completely escaped, and apparently a fair proportion of the maincrop varieties was also free from attack. The following year, however, it was a different story. The disease came much earlier and was far more sweeping and decisive, resulting in an almost total destruction of the crop. Father Matthew[3] wrote under date August 3rd, 1846, as follows:

> "On the 27th of last month (July) I passed from Cork to Dublin, and this doomed plant bloomed in all the luxuriance of an abundant harvest. Returning on the 3rd inst. (August) I beheld with sorrow one wide waste of putrefying vegetation."

Captain Mann[4], R.N., reporting of West Clare, wrote:

> "The early culture of 1846 was in no way improved. A great proportion of the land was again tilled with potatoes, under the expectation that, as in former years, the late scarcity would be followed by a bountiful supply. The first alarm was in the latter

[1]The Agr. and Industrial Journ. for 1848 and '49, p. 299.
[2]See The Farmers' Mag., Dec., 1845, p. 545.
[3]See "The Great Famine in Ireland," by W. P. O'Brien, C.B., 1896. p. 67.
[4]See Ibid, p. 68.

part of July, when the potatoes showed symptoms of the previous year's disease, but I shall never forget the change in one week in August. On the first occasion, on an official visit of inspection, I had passed over thirty-two miles studded with potato-fields in full bloom. The next time the face of the whole country was changed; the stalk remained bright green, but the leaves were all scorched black. It was the work of a night."

Trench[1], writing from Cardtown, Mountrath, says:

"I planted in the year 1846 about one hundred Irish acres of mountain land under potatoes, counting upon a produce worth at least £30 per acre. On August 1st of that calamitous year, 1846, I was startled by hearing a sudden and strange rumour that all the potato fields in the district were blighted. Next day I found the disease was fast extending, and on rooting up some of the potato bulbs under the withered stalks I found that decay had set in, and that the potato was rapidly blackening and melting away. In fields having a luxuriant crop, the stench was generally the first indication of disease, and the withered leaf followed in a day or two afterwards. On August 6th, 1846—I shall not readily forget the day—I rode up as usual to my mountain property, and my feelings may be imagined when, before I saw the crop, I smelt the fearful stench, now so well known and recognised as the death-sign of each field of potatoes."

Trench adds in a foot-note:

"There is no greater fallacy than to suppose that the potato was at that time an uncertain crop. I have been a tolerably extensive tillage-farmer for a great many years, and until 1846 I never had a failure."

The disease appeared in all parts of the country almost on the same day. The Rev. T. Armstrong[2] wrote:

"In August, 1846, I drove some miles to the neighbourhood of Killala. . . . Returning in the evening, we observed a damp, dense mist covering the country on all sides. The next day I had occasion to travel a considerable distance in the direction af Castlebar and Westport. Everywhere the fields presented a melancholy sight. The leaves and stalks of the potato were all smitten with blackness, and already a sickening stench was emitted."

In a very interesting paper read before the Royal Dublin Society by Edward J. Cooper, Markree Castle, Co. Sligo, on the 21st November, 1846, on the disease in the Potato Crop, amongst many points raised he says that seedlings were affected in his garden as early as the end of June, but the field crop "which bore the most healthy appearance on Thursday, the 30th of July, was discovered on the next morning to be grievously blighted."

Great doubt existed as to the cause of the disease. The first person to give the true explanation was the Reverend M. J. Berkeley, a famous English Botanist, who wrote in the "*Gardener's Chronicle*" of 6th September, 1845:

"In every case I found the fungus preceding the work of destruction—it appears while the leaves are yet green, or yellowish green, and the parts attacked soon become brown and withered."

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[1] "Realities of Irish Life," by W. Steuart-Trench, 1868. pp. 100-101.
[2] "My Life in Connaught," by Rev. Thomas Armstrong. Re-issue 1907.

It is now well known that Blight is due to a fungus named *Phytophthora infestans*.

TIME OF OCCURRENCE.—The disease almost invariably appears first each year in the South and South-West and can usually be found there in the last week of May or first week in June. The weather is seldom sufficiently warm for the disease to spread until about the 15th June, but after that date any grower in the South or West who has not sprayed his crop may look out for trouble. In the North, the disease seldom causes damage before 1st July.

WHERE THE DISEASE IS MOST LIKELY TO OCCUR.—Blight may appear anywhere, but it is most likely to start where diseased tubers from the previous year's crop have been left lying about, an old potato pit for example. It is always most severe in damp sheltered situations. Dampness and a certain degree of warmth are necessary for its spread.

APPEARANCE ON THE FOLIAGE.—The first symptoms of the disease are dark brown or blackish patches on the leaflets, generally observable first near the tip or margin of the leaflet. Somewhat similar dead spots are frequently caused by mechanical injury and more especially by wind injury, but in the case of black spots due to Blight, a fine white mould is usually visible on the under surface of the leaflet especially around the margin of the diseased area, and in addition the dividing line between the dead and the still living tissue is usually curved and not straight. When weather conditions favour the fungus the dark-coloured patches spread and multiply rapidly, and the whole plant may soon become blackened.

It is of the utmost importance to note that the disease is in the plant for at least five days before any external symptoms are apparent. Hence the great importance of spraying before such symptoms are seen if the full protective value of the spray is to be gained.

APPEARANCE OF BLIGHT ON TUBER.—In the earliest stages a slight brownish or purplish discolouration of the skin occurs. Under such areas the flesh becomes slightly shrunken, resulting in a depression of the skin. When cut, rusty brown tissues are seen, see Figure 8, which spread from the surface inwards. In dry soils and in boxes this fungus usually causes a dry rot of the tubers, but in damp soils and in pits a wet rot quickly develops owing to secondary organisms (bacteria as well as fungi) following after Blight has killed the tuber. It should be specially noted that this disease does not as a rule, if ever, pass from a blighted to a healthy tuber during storage either in a pit or in a house. The disease does appear to increase during storage, but only on tubers that were already infected, possibly to a degree not visible to the naked eye, before they were pitted or housed.

EFFECTS ON DIFFERENT VARIETIES.—For a great many years past writers have commented on the fact that certain

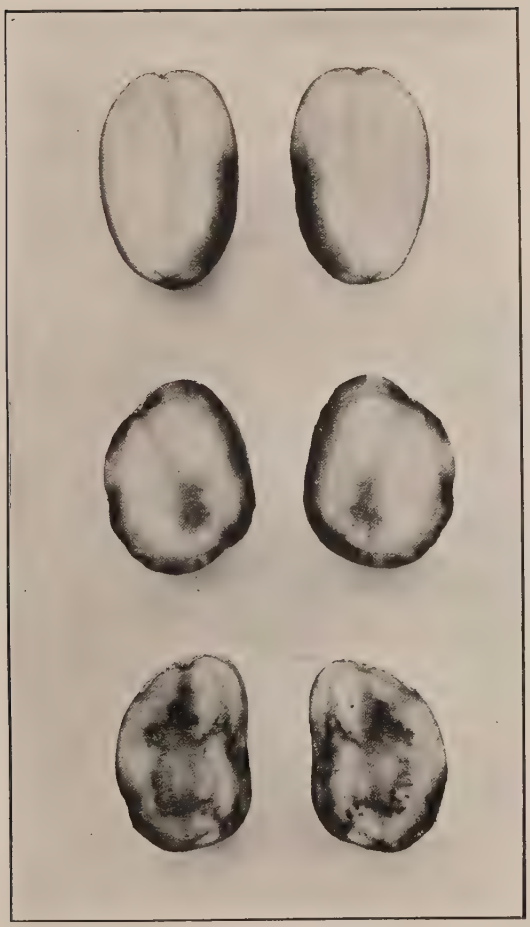

Fig. 8.—Potato tubers cut to show effects of Blight.
(See p. 34.)

Fig. 9.—Stalk Disease. Results of attack by Stalk Disease (Sclerotinia). The two plots with stakes in the foreground were particularly seriously attacked. (See p. 38.)

varieties became more subject to Blight the longer the variety remained in cultivation. This remark was made in regard to Regent, Victoria, Fluke, Rocks, Champion, Magnum Bonum and in more recent times to Up-to-date and British Queen. The Mosaic diseases certainly render a variety more subject to Blight, but even when these diseases are eliminated it is still doubtful if a variety could indefinitely maintain its original degree of resistance to Blight.

Several modern varieties possess a considerable degree of resistance to Blight in the foliage, the most outstanding are Shamrock, Champion II, Irish Chieftain and Leinster Wonder. The fact that the foliage possesses a considerable degree of resistance does not necessarily imply that the tuber does likewise. The tubers of Irish Chieftain for example are very readily infected, whereas the tubers of Golden Wonder and Arran Victory are very resistant though the foliage is not more resistant than many other varieties.

SOURCE OF NEW INFECTION EACH SEASON.—Except in a climate so mild that potato foliage is not killed off during the winter the only known means by which the Blight fungus can survive during the winter and spring months is in the form of mycelium or spawn in blighted tubers. It is very well known now that the disease makes its earliest appearance on plants in the neighbourhood of old pits or clamps, and the reason for this is obvious. It has on several occasions been found that the disease started from plants that were produced by a set affected to some extent with the Blight when planted. It is obvious that every effort should be made to have all diseased tubers boiled, and not thrown about. Indeed the usual practice adopted by potato growers of throwing diseased tubers—no matter what the disease may be—anywhere and everywhere cannot be too strongly condemned.

CONTROL MEASURES.—(1) Spraying with the ordinary Bordeaux or Burgundy mixtures is an absolute preventative of the disease, if the application is made before the disease enters the plant, and provided a good coating of spray is kept on the foliage so long as it remains green. Full particulars regarding spraying are provided in the Department's Leaflet No. 14, which may be had free of charge on application to the Secretary, Department of Agriculture, Dublin.

Under Irish conditions spraying is a necessity for the production of a profitable crop.

SPRAYING IS A PREVENTATIVE AND NOT A CURE.

(2) Another excellent method of controlling the disease in varieties, especially early ones, grown for sale as seed, is to remove the tops either by cutting or burning (see page 17) as soon as the tubers have grown to a sufficient size.

(3) Proper moulding will go a long way in saving the tubers as the spores of the fungus are prevented from reaching the tubers when they are covered with a layer of soil about four

inches deep. The disease reaches the tubers by the spores or "seeds" falling off the foliage on to the soil and being washed down to the tubers. Every observant person who has dug potatoes must have noticed that the tubers nearest the surface are those most frequently diseased.

(4) Potatoes, except for immediate use, should never be dug while the foliage is still green and has the disease on it. Digging should not take place unless the foliage has withered naturally or has been artificially destroyed at least two weeks previously.

(5) Diseased sets should not be planted, for, although it has been proved that diseased sets can produce healthy plants, yet it has also been proved that the first infection of a plant in the field may come from a diseased set or tuber. Diseased tubers should always be boiled or burned, and not, as is often the case, thrown on headlands, into ditches or on to the manure heap.

A ROTTEN POTATO LEFT LYING ABOUT ANYWHERE SHOULD NOT ONLY BE REGARDED BY A FARMER AS A DANGEROUS THING—WHENEVER AND WHEREVER HE SEES IT, BUT ALSO BE TREATED AS SUCH AND SUITABLY DESTROYED.

PREVENTION OF BLIGHT IN SEED POTATOES.

Recent work by Small[1] in connection with the prevention of Blight in seed potatoes deserves serious consideration. Very frequently buyers of seed potatoes for foreign shipment, especially of the varieties Up-to-date, King Edward and Royal Kidney, want early delivery. The crop must be dug before the tops are completely withered, and if no special precautions are taken it is almost a certainty that trouble will follow. The Blight spores from the partially withered tops fall on the tubers and of course escape detection for some days. The tubers are bagged, and all seems well. However, in the course of a few more days the heat and moisture in the bags start the spores to germinate, and by the time the potatoes reach their destination a big percentage is badly diseased.

In Jersey, where Small's work was done, Blight causes serious loss in seed potatoes every year, as the crop must be dug for marketing while the foliage is still green. Small got excellent results by dipping the seed in formalin. This method aims at killing the spores which fall on the tubers at digging time.

It is to be expected that some disease may occur occasionally in spite of the dipping, because a few tubers are probably infected, though not visibly, when dug. In older attacks the number of such infected tubers may be appreciable.

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[1]Small, T., Ph.D. Prevention of Blight (Phytophthora infestans) in Seed Potatoes. The Annals of Applied Biology, Vol. 22, No. 1, Feb., 1935.

The treatment recommended by Small is simple, practical and not expensive. The apparatus consists of:—

(1) A low, wide wooden tub containing sufficient fungicide to allow complete immersion of the seed box full of tubers.

(2) A piece of corrugated iron or other support to form a draining board.

(3) A wooden container with high sides and two handles and just large enough to hold a seed box. It prevents the tubers falling from the seed box during dipping.

(4) The fungicide recommended is a 1 per cent. solution of formalin (1 pint of commercial, 40 per cent., formalin in 99 pints of water). Fifteen gallons are sufficient for hundreds of boxes.

The seed is placed in the boxes when dug in the field and brought to the farm. As each box is unloaded it is placed in the wooden container, dipped in the fungicide, and transferred to the draining board to allow excess fungicide to run back into the tub. The box is then stacked in the usual way. With four men working, one unloading the boxes, two dipping and one stacking, 360 boxes of seed were treated in one hour. The formalin is not injurious, solutions up to 3 per cent. have been tested, and the treated and untreated seed sprouted equally well. It is obvious, of course, that the seed must be dipped soon after digging, before the spores have germinated and infected the tubers.

The success of the treatment seems to depend on having the dipping done before the spores germinate. If it is done in good time the treatment appears to be eminently successful, and is certainly worth trying on seed dug *early for foreign shipment*.

THE STALK OR SCLEROTINIA DISEASE.

This disease appears to have been first recognised in this country in 1880[1]. In that year Mr. Ambrose Balfe, Secretary of the Royal Horticultural Society of Ireland, reported on the existence of a peculiar disease in potatoes in County Sligo. The disease was investigated by Worthington Smith[1] in the early eighties, by McWeeney[1] in 1895 and more fully by Pethybridge between 1909 and 1916. Sufficient information has been collected to enable the damage caused by this disease to be reduced to negligible proportions, in fact the disease could be exterminated if growers were prepared to put into practice the information that has been placed at their disposal. In 1890[2] Carroll wrote:

> "This disease is extremely destructive of potatoes in the extreme West of Ireland, but from the mode of propagation of the fungus by 'resting spores' in the haulm it should be easily stamped out."

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[1]The New Disease in Potatoes, by Thos. Carroll. Appendices to 57th Report of Commissioners of National Education in Ireland, 1890.

[2]Ibid.

No practical efforts were made to deal with this disease, and in 1913 Pethybridge wrote:

> "Next to the Blight, this disease is probably the most serious one in the West of Ireland." See Figure 9.

Improved methods of cultivation in recent years have greatly reduced the damage caused by the disease, but there is no reason why seed growers should not be able to eliminate it altogether from their crops. The disease is fortunately not tuber-borne.

CAUSE OF THE DISEASE.—The disease is caused by a fungus to which various names have been given but the one now recognised is *Sclerotinia sclerotiorum*. Many local names were applied to the disease in the West of Ireland, such as "White Spot," "Falling at the Butt," "Haughing," "Ground Rot," etc., —all more or less indicative of its appearance, or the appearance of the affected stalks at some stage of its progress.

TIME OF OCCURRENCE.—Worthington Smith[1] wrote:

> "The disease was first noticed in the beginning of July, at the time the potato flowers were opening, but there can be little doubt that it was in or upon the plants several weeks previously, as by its nature it would not attract much attention at first."

Pethybridge found that the date of the first attack varies with the season, dry weather in May and June delays the attack. At Clifden the disease may appear on the stalks as early as the 8th June, but in 1915 when the weather was unusually dry, no affected plants were noticed until 10th July. The disease continues its nefarious work until the foliage begins to ripen or is destroyed by Blight.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—McWeeney[1] correctly described the conditions most favourable to the disease:

> "crowded growth of potato plants in a poor, shallow, peaty or sandy soil, especially where the same field is sown year after year with potatoes";

but he added:

> "The ridge system seems to favour the growth of the fungus rather than that by drills,"

whereas Pethybridge found that the disease was quite as bad when the potatoes were grown in drills. It is just possible that the idea which is generally held that Stalk disease attacks the crop more severely when grown in ridges may be accounted for by the fact that those who grow potatoes too often on the same land in the West of Ireland usually adopt the ridge system, whereas the drill system is usually adopted by the larger farmers who follow a rotation of crops. The disease was bad, in County Donegal in 1896. In that year Carroll[1] wrote:

> "The worst possible system of cultivation is that of growing the crop upon the beds that had in the previous year carried a crop of potatoes. I may remark the drill system in potato cultivation appears to be extending in County Donegal."

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[1]The Sclerotium Disease of Potatoes. Appendices to 63rd Report of Commissioners of National Education in Ireland, 1896.

Fig. 10.—Stalk Disease. The white bodies on the surface of the stalk are immature "sclerotia."

(See p. 39.)

Fig. 11. —Stalk Disease. Three potato stalks split open showing numerous "sclerotia" in their hollow interiors. (See p. 39.)

The drill system is now universal amongst the seed growers in County Donegal and the Stalk disease has disappeared.

APPEARANCE ON FOLIAGE.—

"In its earliest stages, seeing that nothing particularly remarkable is shown by the foliage, it is apt to be overlooked. But a careful examination of the stems or stalks of plants at a stage when the attack has not long started, say, early in the month of July, usually reveals the presence on the outside of the stalk of a whitish mouldy growth, often, but by no means always, rather near the soil level. If the weather conditions are favourable for the fungus (for the white mould is the vegetative thread-like body of a parasitic fungus responsible for the 'stalk disease') the mould increases in amount and forms snow-white, spherical or oval cushions on the outside of the stalks on which drops of a clear liquid like water can sometimes be seen. Figure 10 is reproduced from a photograph of these white bodies developing on the stalk. As time goes on these bodies become firm and hard and then change their appearance from white to grey or black. If cut at this stage with a knife, although black externally, they are seen to be white within, and are about the consistency of hard wax. When ripe, these black bodies fall off the stalks and so reach the soil. The fungus, however, does not develop only on the outside of the potato stalks; indeed, if the weather be dry, none of these black bodies (or *sclerotia* as they are technically called) may develop on the outside. On the other hand, the fungus invades the stalk, reaches its interior and destroys the living tissues as it does so, filling up the pith cavity of the stem. Figure 11 is a photograph of stalks which have been thus attacked and were split open to show the numerous now ripe *sclerotia* in their hollow interior. When the stalks decay, and are left on the land, these internal *sclerotia*, of course, also reach the soil. As a result of the attack of this fungus on the stalk the water and sap-channels in the stem become disorganised, water cannot reach the leaves from the soil, and, consequently, the leaves become limp and wilt, without, however, necessarily becoming yellow.

Soon after this wilting occurs, or even before then, the stem, owing to its weakness at the point of attack, falls over, a sort of kink being produced as a rule, and not an actual fracture, and the stalk is said to be "haughed." This toppling over of the stalk often occurs near its base at the soil level, hence the names "Falling at the Butt" (and 'Ground Rot') given to the disease in some districts. But many cases were observed where the point of attack was by no means at or near soil level but far above it. See Figure 12. Plants attacked in this way are, of course, of no use as regards the further development of the tubers, and the earlier the disease starts in the season the greater is the loss it causes.

If the destiny of the small black bodies or *sclerotia* be followed, it will be found that after resting in the soil like seeds, over the winter, they germinate in the early summer and each one produces on the surface of the soil one or more funnel, cup or disc-shaped structures about the size of a threepenny piece or smaller. A small group of these "spore-cups," as they may be termed, appearing above the surface of the soil is shown in Figure 13. If carefully lifted out of the soil, the spore-cups are found to be connected with the buried *sclerotium* by rather slender crooked stalks, longer or shorter according to the depth of the *sclerotium* from the surface of the soil. If the spore-cups be watched and gently breathed upon or lightly touched, each one may be seen to produce a little smoke-like puff which consists of a mass of minute spores, which are thus actively exploded, so to speak, into the air, and it is from these spores that the disease is contracted. Figure 14 shows a number of germinated *sclerotia* with their stalked spore-cups, together with the puff of spores emanating from them. The production of puffs of spores from a spore-cup may continue for as long a period as two or three weeks before it is exhausted."[1]

[1]Potato Diseases in Ireland, by Geo. H. Pethybridge. Jour. Dept. Agr. & Tech. Inst. for Ireland, Vol. X, No. 2, Jan., 1910, pp.248-9.

EFFECTS ON DIFFERENT VARIETIES.—"It is strange that other potatoes named "Protestants" (White Rocks) growing close to the "Champions" were not attacked."[1] Pethybridge found Irish Queen to be particularly susceptible, Up-to-Date almost equally bad, Champion decidedly less so, while Champion II and Summit (two very late varieties) showed no case of the disease. Invincible, Shamrock, Arran Chief and Black Skerry were decidedly less affected than Champion, Up-to-Date or Irish Queen.

SOURCE OF NEW INFECTION EACH SEASON. -The spores produced in the spring and early summer by the *sclerotia* which lie dormant in the old stalks and in the soil during the winter, give rise to new infection. Pethybridge proved for the first time that infection is due to air-borne spores, and does not come directly from the soil. He also proved that these air-borne spores are incapable of entering normally vigorous green potato foliage but can attack leaves yellowing and ripening off, and through these yellowing leaves can enter the main stem. Infection usually begins as soon as some of the oldest leaves on the lower portions of the stem begin to wither.

CONTROL MEASURES.—

"It is perfectly clear that this disease is perpetuated by:—

(1) Allowing diseased potato haulms to discharge their *sclerotia* on the land where the potato crop has grown; or by the system so general in many places of putting these haulms into the manure heap.

(2) Allowing the potato haulms to remain on the ground until they become withered and dry. They are at this stage brittle, they break readily, and discharge the *sclerotia* over the land.

THE OBVIOUS MEANS OF STAMPING-OUT THIS DISEASE IS.—

1. To carefully watch the progress of the crop of potatoes and, when the disease makes its appearance, the plants that are affected should be pulled up before the *sclerotia* are matured. These affected plants should be destroyed by burning them, as it may be possible that the *sclerotia* would come to the state of maturity in the stalks even after the stalks had been pulled.

2. By not growing a crop of potatoes upon land that has in the year previous carried a crop of potatoes; indeed it would be advisable to allow several years to intervene between potato crops in districts that are subject to this disease. Good cultivation and, where possible, adopting the drill system will do much to minimize the disease."[1]

This information for the control of the disease was given by Carroll in 1896, and it cannot be much improved upon. Pethybridge's discovery that the spores are air-borne shows the necessity for not planting potatoes on land that adjoins a plot badly infected the previous year. Burn all diseased stalks as early as possible, cultivate thoroughly, and leave as long a period as possible between two potato crops, or in other words follow a good rotation and the Stalk Disease will cause no serious loss.

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[1]Appendices to 63rd Report of Com. of National Education in Ireland, 1896.

Fig. 12.—Stalk Disease. A stalk attacked in two places high up and away from the soil, at one of which fracture has occurred. (See p. 39.)

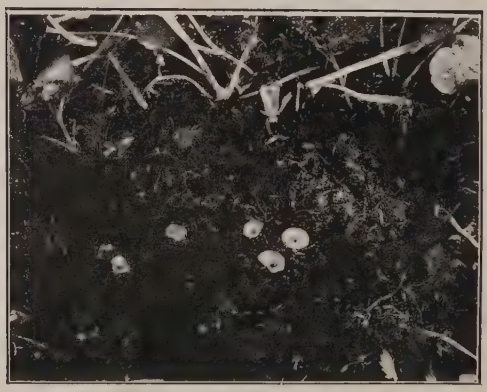

Fig. 13.—Stalk Disease Six " spore cups " as seen on the surface of the soil under the potato stalks.
(See p. 39.)

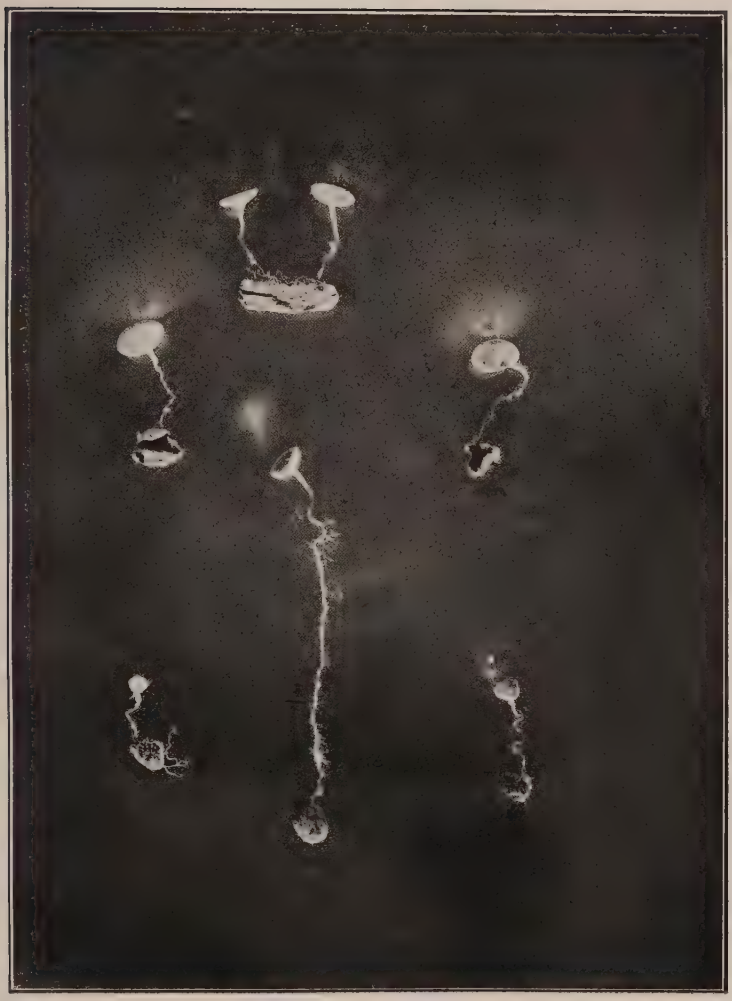

Fig. 14.—Stalk Disease. Six "sclerotia" which have germinated and produced stalked "spore-cups." Escaping from the "spore-cups" the cloud-like puffs of spores can be seen. (See p.39.)

In the West of Ireland, Pethybridge found there was less disease on late planted crops, as there are fewer old leaves at the time when the spore-cups are discharging their spores and thus less chance of infection from them. There is a limit, however, to the lateness to which it is advisable to delay planting. Wherever the disease is severe potatoes should not be grown again for at least two years—the longer the period the better.

BLACK SCURF AND STEM CANKER.

Black Scurf, also known as Black Speck Scab, is recognized by the occurrence of small dark brown bodies on the surface of the tuber known as *sclerotia.* They are easily scratched off with the finger nail and do no actual damage to the tuber. They are, however, the resting bodies of the fungus mentioned below, and serve to maintain and spread it.

This disease, although widespread in Ireland, causes little loss here, and is probably unknown to the majority of potato growers. Seed growers must, however, pay attention to it, as it causes very heavy losses in some countries warmer and dryer than ours. In a pamphlet published by the Utah Experiment Station it is stated that this disease "is probably the most common and one of the most destructive of all potato diseases." In South Africa, in Portugal and in some other countries, it is one of the first things that a seed potato buyer looks for when making his purchases, and it is a matter of the greatest importance that Irish Free State seed should be free from this disease.

CAUSE OF THE DISEASE.– The disease is caused by a fungus which was long known (and, indeed, is still so known in some countries) under the name of *Rhizoctonia Solani.* When its mode of fructification was discovered, the name had to be changed to *Corticium Solani.*

TIME OF OCCURRENCE.—The fungus itself is first noticed as a white web around the stems of the plant just above ground level, and in this condition it is known as the "Collar Fungus." This appears usually in late June or July and is the fructifying or sporulating stage of the fungus. The white web is easily rubbed off, and the fungus does not enter the stem here, or cause it to rot.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—The disease is most likely to be serious in warm dry countries, but it is also important in those countries in which cold wet weather is likely to occur at, and persist after planting time. In Ireland the disease occurs mostly in fields or gardens where potatoes are too frequently grown, because the fungus lives in the soil and luxuriates there if potatoes are grown too frequently in it.

EFFECTS ON FOLIAGE.—The disease may attack the sprouts, see Figure 15, browning and killing their tips. As a result the sprouts branch, and the tips of the branches also may be killed, especially when the sets have been planted in wet land during cold weather. Under the worst conditions the sprouts may

ultimately all be prevented from reaching the light, and "misses" are the result. When conditions are not so bad, some of the sprouts may develop into stalks, but the plant, of course, has received a check from which it can never completely recover. Even when overground stalks have been produced, the fungus is capable of attacking their underground portions, and causing what is now called Stem Canker. Sometimes these attacks are negligible in effect, but they may be so severe that the stalk becomes ringed below ground, see Figure 16, and occasionally cut right through at the point of attack. The roots may also become attacked, especially their tender tips. The stolons on which the new tubers are formed may also sometimes suffer, but on the tubers themselves the fungus remains superficial; it never causes tubers to rot.

On account of the injury to the roots and stem, resulting in a shortage of the water supply, the leaflets at the top of the plant frequently show rolling, but remain soft and present a wilted appearance, indicating attacks of the fungus below soil level.

APPEARANCE ON TUBER.—This disease usually appears on the tuber as small black specks, see Figure 17, that can easily be scratched off without leaving any appreciable mark on the skin. Occasionally, tubers will be found thickly coated in large patches with this black material. This condition is, however, very rare in Ireland.

EFFECTS ON DIFFERENT VARIETIES.—No records have been made of the effects of this disease on different varieties, but there is no doubt that some varieties suffer more than others. The worst cases seen by the writer were on "Epicure," "Champion" and "Edzell Blue," though this does not prove that these varieties are the most subject to this disease.

SOURCE OF NEW INFECTION EACH SEASON.—The black specks or *sclerotia* when present on the seed tubers produce the disease, and in this way it is carried on from one season to another, as well as from place to place, see Figure 17. The *sclerotia* may also be present in the soil, hence another case of the desirability of a good rotation. Treatment of the seed to kill the *sclerotia* has frequently been recommended in America and elsewhere, but so far the results are not sufficiently satisfactory to commend the treatment to growers in this country.

CONTROL MEASURES.—(1) Sprout the seed in a well-lighted house in suitable boxes. Seed sprouted in good light will seldom suffer from Stem Canker, or indeed from several other diseases. Apart from avoiding such diseases, sprouting the seed should be a universal practice, see page 10.

(2) Follow a good rotation, and keep as long a period as possible between successive potato crops.

(3) As far as possible affected seed should be avoided.

(4) Good cultivation and liberal manuring force the plant over the critical stage.

(5) Seed tubers badly affected with Black Scurf will not be passed for sale in sealed bags.

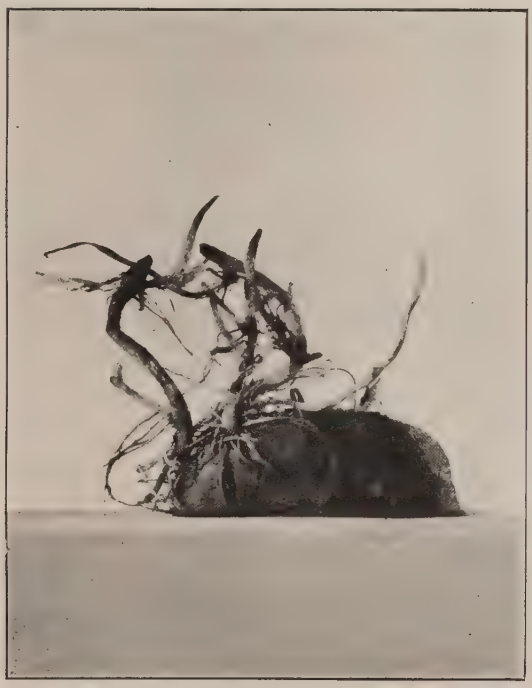

Fig. 15.—Stem Canker. A potato set which was planted and failed to grow owing to attacks of sprouts (blackened tips) by Stem Canker fungus (*Corticium Solani*) (See p. 41.)

Fig. 16.—Stem Canker. Base of a potato stalk affected by stem canker and aerial tubers produced as a result of injury to the stem. (See p. 42.)

VERTICILLIUM WILT.

This disease was first recorded in Ireland by Pethybridge[1] in 1909. It was not, however, really a new disease, but one which had undoubtedly been included in the old days along with certain others under the comprehensive term "Curl." Pethybridge said:

> "The trouble does not appear to be of any serious consequence in Ireland at present,"

and that statement practically holds good to-day. The reason for including it here is to warn growers of its existence, so that they might take steps to remove any sickly wilting plants from their crops as soon as detected, see Figure 18.

CAUSE OF THE DISEASE.—The disease is caused by a fungus known as *Verticillium albo-atrum*, which lives in the plant, and may be found in the stems, foliage, roots and the new tubers, particularly in the sap-conducting tissues.

TIME OF OCCURRENCE.—At Clifden this disease showed up about the third week in July, though like most diseases, the time of occurrence will vary with the season. As a rule the plants are fairly well advanced before the disease is observed, though in severe cases the plants may be only a few inches high, and may grow no higher.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—This disease is most likely to occur on lighter soils, and its effects are worse in dry seasons and in comparatively dry and warm climates.

APPEARANCE ON FOLIAGE.—The symptoms of this disease might at first sight be mistaken for those of Black Leg, but there is this important difference, namely, that in Black Leg the stalk near to and below the soil level always becomes black and rotten, whilst in the Verticillium disease the stalk remains apparently sound and healthy externally. The leaves are usually pale and the leaflets often become rolled or folded just as in Leaf Roll. Eventually they turn brown, dry up and the plant dies prematurely. The upper internodes may fail to elongate, and so the leaves become more or less crowded together, see Figure 18. The stalks of plants killed by Verticillium disease often show black streaks along their length. When an affected stalk is cut across, the interior is not found to be rotten as in Black Leg, but the vascular bundles show a yellowish brown tint, lighter in colour than in a stem affected with Black Leg.

It is often by no means easy to distinguish Verticillium disease from Leaf Roll,—a microscopical test is necessary to make sure —but even if they are confused no great harm is done as both must be eliminated from crops intended for seed.

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[1]Pethybridge, G. H., B.Sc., Ph. D. Potato Diseases in Ireland. Jour. Dept. of Agr. & Tech. Inst., Vol. X, No. 2, Jan., 1910.

APPEARANCE ON TUBER. —There are no external signs of the disease, and no rotting of the tuber takes place, although most of the tubers produced by diseased plants carry the infection in them. If a small slice be removed from near the heel end of an affected tuber, a discoloured brownish ring or series of streaks will usually be disclosed on the surface of the cut. Potato tubers with a pronounced discolouration of this kind at their heel ends should always be looked upon with suspicion for seed purposes, although it is only fair to say that this browning of the heel end of a tuber is not an *infallible* sign of this or of any other disease. The detection of the presence of the fungus by microscopical means is the only way in which the disease in the tubers can definitely be diagnosed.

The presence of the fungus in the tuber does not prevent the latter from sprouting in normal fashion. When, however, infected tubers are planted, the fungus sooner or later passes into the young stalks, and causes in them the symptoms already described. Not infrequently the plants arising from such tubers are small, in some cases almost dwarfs. In one case a large tuber over five inches in length produced only a tiny plant with a few very small new tubers.

EFFECTS ON DIFFERENT VARIETIES.—The case investigated by Pethybridge occurred on "Duchess of Cornwall" (Up-to-date), but there is at present no information as to whether there are any differences in susceptibility or resistance amongst our ordinary varieties.

SOURCE OF NEW INFECTION EACH SEASON.—Plants may become infected from soil in which diseased plants were grown the previous season, but the usual source of infection is seed tubers that are the produce of diseased plants.

CONTROL MEASURES.—(1) Destroy by burning all the remains of a diseased crop, for the fungus persists in the dead parts, and if they reach the soil it will become contaminated.

(2) Land which has borne a crop infected with this disease should be left free from potatoes for as long a period as possible.

(3) Tubers from a crop affected with this disease should never be saved for seed.

BOTRYTIS DISEASE.

This is another disease unknown to the great majority of potato growers, yet in certain seasons it can cause a considerable amount of damage.[1]

The injury caused by Botrytis is generally ascribed to Blight or the Stalk Disease, and the fact that the Botrytis disease has

[1]Investigations on Potato Diseases, by G. H. Pethybridge, B.Sc., Ph.D. Jour. Dept. of Agr. and Tech. Inst. for Ireland, Vol. X, No. 2, Jan., 1910, p.250; Ibid, Vol. XI, No. 3, April, 1911, p. 435; Ibid, Vol. XVI, No. 4, p. 17.

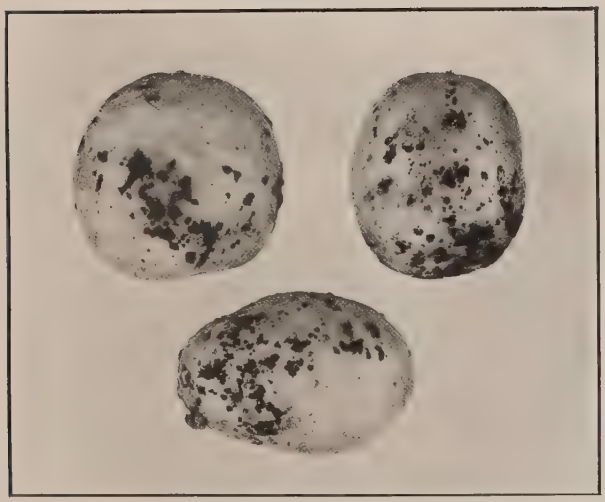

Fig. 17.—Stem Canker and Black Scurf. Tubers affected with Black Scurf. The black bodies are "sclerotia" of *Corticium Solani*. (See p. 42.)

Fig. 18.—A potato plant affected with the Verticillium disease in the drill. (See p. 43.)

Fig. 19.—Botrytis Disease. A potato plant in process of destruction by the Botrytis disease. (See p. 45.)

Fig. 20.—Portion of a potato stalk showing the characteristic mode of fracture at a node due to an attack of Botrytis disease. (See p. 45.)

Fig. 21.—A potato stalk with the black adhering sclerotia of Botrytis disease. (See p. 46.)

Fig. 22.
A potato stalk similarly affected as in Fig 21, showing the tufts of spore-bearing mycelium which have developed from each sclerotium.
(See p. 46.)

no common or even a local name shows that it has not been recognised by the ordinary grower. The generally accepted belief was that Botrytis did not rot the tubers, but Folsom[1] proved a few years ago that it can cause rotting.

CAUSE OF THE DISEASE.—The disease is caused by a fungus known as *Botrytis cinerea*.

TIME OF OCCURRENCE.—Like most other diseases the time of occurrence varies to some extent with the season and more especially with the weather. As a rule this disease does not appear until the end of June, July or even early August. It is liable to be mistaken for Blight, though there are several fairly obvious distinctions.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—This disease appears where persistently wet atmospheric conditions prevail, as in wet cool summers. When moist warm conditions prevail Blight flourishes, but when the weather is moist and cool, it favours Botrytis. This disease is often found in various plants kept in unheated greenhouses in Winter.

APPEARANCE ON FOLIAGE.—1. Infection normally occurs on the young and apparently perfectly healthy green foliage during a spell of continued wet and cool weather. The apex or point of the leaflet is often affected first, a feature which rarely happens in the case of Blight.

2. The first obvious signs of the disease are brown dead areas on the leaflets, which may be of various shapes and sizes and situated in various regions of the leaflets. The base of the dead area is often V shaped, so long as the leaflet is not wholly browned.

3. Contraction of the killed portions of the leaflets occurs, and thus they become more or less curled or contorted when dry.

4. From the first-infected leaflets the disease spreads to the others of the same leaf, and from it to the stem, the spreading being caused largely by the growth of the internally situated spawn or mycelium.

5. The disease progresses distinctly from above downwards, and finally involves the death of the whole plant, see Figure 19.

6. In wet weather the spread may be quite rapid, but it becomes slower or ceases almost entirely, if the weather becomes dry.

7. The fungus frequently attacks the stems more severely at the nodes and the consequence is that the stalk often fractures at a node in a rather characteristic manner. See Figure 20.

8. While the lower leaves may fall off either before or after infection and death, many of the upper dead leaves remain much longer attached to the stalks, and their weight frequently causes the upper part of the stalk to fall over.

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[1]Folsom, Donald. *Botrytis cinerea* as a cause of Potato tuber rot. Phytopathology, December, 1933. Vol. XXIII, No. 12.

9. In the case of Botrytis, a fine greyish or brownish mould (the spores and mycelium of the fungus) may be seen on the brown dead areas of the leaflets whereas in the case of Blight, the mould is seen on the dividing line between the green living portion of the leaf and the black dead portion.

APPEARANCE ON TUBER.—Until 1927 it was generally believed that this fungus did not attack the tuber. In that year a Boytrytis was isolated from several soft-rotted tubers stored in Maine, U.S.A.

Folsom[1] in the spring of 1932, while examining potato tubers of the Green Mountain variety, found tubers with apparently a new kind of rot. The exterior of the tuber showed a flabbiness and a wrinkling of the skin that were more pronounced as one approached the stem (heel) end of the tuber. A cut though the conspicuous junction of flabby and normal solid tissue disclosed a rot that was rather soft though not wet unless squeezed, and that was advancing in the interior and causing a temporary darkening of the flesh. Where the rot had penetrated the tissues, the eyes were filled with tufts of grey mould. The diseased tubers appeared to have been infected at the stem end. Folsom held the view that tubers become infected chiefly or only by internal mycelium entering from infected stems through the stolons.

Tuber rot due to Botrytis is certainly of no consequence in Ireland at the present time.

EFFECTS ON DIFFERENT VARIETIES.—Pethybridge found that varieties which were resistant to Blight were also resistant to Botrytis.

SOURCE OF NEW INFECTION EACH SEASON.—A number of black flattened bodies (*sclerotia* which are the resting bodies of the fungus, and which serve to tide it over the winter may be seen adhering to the old bleached stalks, see Figure 21. In Spring and early Summer these *sclerotia* germinate and produce an immense number of spores and reproduce the disease again if the conditions already mentioned prevail. Figure 22 gives an idea of the number of spores that can be produced on a small piece of an old potato stalk.

CONTROL MEASURES.—(1) It is obvious how desirable it is that all old stalks should be burned not only to destroy this disease, but also some other diseases.

(2) Spraying has no effect on this disease.

(3) Follow a good rotation.

(4) Plant seed from a healthy crop.

[1]See footnote, page 45.

VIRUS DISEASES.

What is a virus disease? Nobody knows what a virus is, but for present purposes a virus may be assumed to be an organism so small that it cannot be seen even with the aid of the most powerful microscope. Its various actions can best be understood by regarding it as something alive, although future research may prove that a virus does not consist of actually living substance.

There are several viruses that affect the potato plant, the exact number is not yet known, but there are seven that must be considered, and there are others awaiting further investigation. With the exception of the Leaf Roll virus, the potato viruses are distinguished not by names but by letters, and are in their probable order of importance:—Leaf Roll Virus, Virus Y, Virus X, Virus A, Virus B, Virus D and Virus G. These viruses are not uniformly distributed throughout Great Britain and Ireland. In the best seed districts along the North and West Coast of Ireland the Leaf Roll Virus and Virus Y are rare, while Virus X is universal, though how it is spread is not known. Virus A is fairly common, Virus B is also common. Virus G, which causes Aucuba Mosaic, seems to be of little practical importance, and though Virus D was not discovered until 1933, it was (like all the viruses) probably in existence for a great many years previously.

The virus, whatever its nature, can be transmitted from a diseased to a healthy plant by certain sucking insects, the most important distributor known at present being a species of greenfly, *Myzus persicae*. This insect is mainly responsible for the transmission of the Leaf Roll Virus and Virus Y, but there are other viruses this insect cannot transmit, and how they are spread has not been discovered. Virus X, for example, is nearly universal in distribution, and yet nobody knows how it spreads. It is well to note that the greenfly does not itself cause the disease, it acts only as a distributor to healthy plants when diseased plants are about. Viruses can also be transmitted by various artificial means, which though not of much concern to potato growers are of great value for research purposes.

Insects, especially greenfly, are without doubt the principal distributors of virus diseases in the field. In consequence it is obvious that if there are no insects present the diseases will not spread, and also if there are no diseased plants nearby, the insects, even if present, cannot spread the diseases. Hence the best districts for seed production are those free, or as nearly as possible free from insects. It is also clear why diseased plants should be removed as soon as they are noticed, for they cannot then serve as centres of infection. It usually happens in practice that they have served as centres of infection before they are noticed, and to make matters worse the insect "spreaders" are most active in June, so that very often all plants adjacent to a diseased plant are smitten before the diseased plant is removed. "Groundkeepers" in a crop of oats, or even in a hay crop sometimes serve as centres of infection, hence the

importance of getting all tubers out of the ground. More research work is necessary to discover which districts are least favourable to greenfly and other forms of insect life, and in consequence most suitable for seed production. In general bleak wind-swept districts with a cool moist climate are most satisfactory.

Maldwyn Davies showed that *Myzus persicae*, the best known spreader of Leaf Roll Virus and Virus Y, is very inactive when weather conditions are cool, moist or windy, while it becomes particularly active in warm dry calm weather.

It cannot be too much emphasized that all potato virus diseases are "hereditary" in the sense that they are tuber-borne, although they are not transmitted in the true seeds formed in the "plums" or "apples" of those varieties that produce them. If a tuber containing a virus disease is planted, every tuber produced by the plant will in turn produce diseased plants. It is in this way that the degeneration of all varieties comes about. After a number of years—the number depending on various conditions—the percentage of virus-affected plants in a given stock becomes so great that the yield is seriously reduced. If a variety was multiplied in its early years under favourable conditions it may have succeeded in escaping general infection for a long time, whereas some varieties have been ruined before they were generally established through being grown (while only small stocks were in existence) too near virus-affected crops. Furthermore, the effects of the different viruses on different varieties are markedly different.

The virus diseases are the main, if not the only cause why growers in England and all dry warm countries have to change their seed. It should in consequence be obvious that the true criterion of seed potatoes is freedom or otherwise from virus diseases. Plants affected by the Leaf Roll Virus will often not produce 10 per cent. of a normal yield, while very seldom is more than 50 per cent. of a normal crop produced. The effects of Virus Y are often quite as bad; in fact in certain cases they prove fatal. A combination of two or more viruses in the same plant also proves very injurious and may cause fatal results.

It should not be necessary to emphasize any further the absolute necessity of having crops, especially those intended for seed purposes as free as possible from virus diseases.

As already mentioned, there are at least seven distinct viruses that are sufficiently well known to justify their being taken into consideration here. Each of these viruses can by itself cause a disease in potatoes, but very often two or more viruses may be present together in the same plant, and give rise to symptoms quite different from those produced by either virus when present alone.

The position is made more difficult by the fact that each virus does not necessarily produce the same symptoms in different varieties. Indeed a virus may be present in a variety when no symptoms of its presence there are evident. In that case the variety is said to be a "carrier" of that particular virus. When

the symptoms are only of a very minor nature such as a slight mottle, without puckering or wrinkling of the foliage or a serious reduction in the size of the leaflets the variety is said to be "tolerant" of that particular virus. The symtoms due to attack by the Leaf Roll Virus are fairly constant and there is little difficulty in identifying this disease. Virus Y, however, produces very different symptoms in different varieties. In some, such as Up-to-Date and Majestic it produces Leaf Drop Streak, see Figure 33, a very bad disease, while in some others, such as Arran Victory, the same virus causes only a mild mottling; Di Vernon can carry Virus Y without showing any symptoms.

On the other hand, Virus B is carried by Up-to-Date without any external symptoms, whereas the same virus when transferred by grafting to Arran Victory causes Top Necrosis which soon proves fatal. It is well here to note the danger that arises if two varieties are grown as "Health Stock" in close proximity. There is always a risk that one or both varieties may be carrying a virus without any apparent symptoms. Yet should the hidden virus of one variety be conveyed by insects into the adjoining variety, severe effects would soon be apparent. Of course, if the "Health Stock" were raised, as it should have been, from plants tested in the laboratory for freedom from virus diseases, the same danger would not exist. However, "Health Stock" seed of any variety should be multiplied in isolation, unless this is absolutely impossible.

The effects of the different viruses on the principal commercial varieties have not all been recorded but such as are available are given later.

The diseases of the potato caused by a virus or a combination of viruses, and now to be considered are:—

Leaf Roll
Diseases of the Mosaic Type
Aucuba Mosaic,
Simple Mosaic,
Intervenial Mosaic,
Crinkle.

Streak Diseases
Leaf Drop Streak,
Top Necrosis,
Foliar Necrosis.

Detailed particulars regarding each disease are given later. These diseases are "hereditary." Every tuber from a diseased plant will produce a diseased plant. All these diseases spread in the field from diseased to healthy plants, the spread is much more rapid in some districts than in others. Insects are probably the principal distributors. Insects feeding on the sprout also spread these diseases in the sprouting boxes from diseased to healthy tubers.

The same methods of control apply in all cases:—

(1) Seed crops should be free from virus diseases.

(2) It is useless to attempt to produce "Health Stocks" or stocks free from virus diseases by digging out affected plants. All that has ever been achieved by this method is to keep the stocks from becoming worse.

(3) "Health Stocks" should be raised, in good isolation, from specially selected plants free from virus diseases (See Section V.)

(4) Seed crops should always be grown well isolated from other potato crops, see Figure 73.

(5) Seed potatoes should be grown only in districts where Leaf Roll Virus and Virus Y are rare.

(6) Bleak wind-swept districts with a heavy rainfall and without long dry spells are the most suitable for seed production.

LEAF ROLL.

Almost as soon as the potato began to attract attention as a field crop in England about the middle of the eighteenth century, a number of plants were noticed with "curled" foliage due apparently to some disease. Substantial prizes were offered by various societies for a remedy for this trouble which came to be known as the "Curl".

It is significant that Arthur Young, though well acquainted with the disease, never mentions "Curl" in his *Irish Tour*, 1776-79, showing that it was not a pressing problem, in this country. Even since Young's time, "Curl" has never attracted serious attention in Ireland, indeed the potato apparently flourished like a weed until it was attacked by Blight in 1845.

There can be no definite proof, yet it may be accepted that what is now called Leaf Roll was the principal disease included under the old name "Curl".

The name Leaf Roll disease was first employed in the early years of the present century on the Continent, but even at that time the term was unwittingly applied to what we now know to have been more than one specific disease. Hence much confusion arose. Thanks mainly to Dutch workers in the first instance, however, the symptoms of true Leaf Roll gradually became more precisely characterised, and it was at last made clear that this disease was one caused by a virus.

Since this discovery was made, many research workers have devoted their attention to Leaf Roll, and the work done in this country by Murphy and McKay, reports of which have appeared in the Department's Journal, has brought home to potato growers, more especially the seed potato growers in the Irish Free State, the economic importance of this disease, and the necessity of keeping their crops free from it. It has been found possible in this country to set up and maintain a standard for

Fig. 23.—A potato plant affected with Leaf Roll. Variety, President.
(See p. 51.)

Fig 24.—A potato plant affected with Leaf Roll. Variety, British Queen. (See p. 51.)

seed crops with regard to freedom from Leaf Roll that no other country has been able to do, thanks to climatic conditions in the seed-growing districts and to the information provided by the research work done by Murphy and McKay.

No crop is certified as suitable for seed purposes if one plant affected with Leaf Roll is found in the field where the crop is grown.

Cause of the Disease.—As already mentioned the cause of the disease is a virus, but the exact nature of this and other viruses is still unknown.

Time of Occurrence.—The disease cannot usually be recognised with certainty until the plants are about one month over ground, and sometimes even later.

The characteristic symptoms of the disease are most marked in plants produced by the tubers of diseased plants of the previous year. In such cases the following particulars should enable any person to identify Leaf Roll.

The plant is invariably stunted, more so in some varieties than in others. The margins of the lower leaves roll upwards and inwards, so that they are more or less funnel-shaped, see Figure 24. Such rolled leaves are thick, tough and leathery. The tips of the terminal leaflets frequently turn brown and die, especially on the older leaves. The whole plant usually assumes a pale colour, accounted for to a large extent by the exposure of the pale under-surface of the leaflets to view. The leaflets are usually more crisp than normal, and when knocked together make a rattling sound. The general effect of the disease on the plant varies considerably with the variety, and varieties may be classed in at least three groups:—

A. Varieties with upright habit of growth such as President, Kerr's Pink, Champion, Golden Wonder, Black Skerry, Arran Consul, Dunbar Standard, Arran Chief, King Edward, Arran Cairn. These varieties are very intolerant of the disease, and when affected with it are much stunted and assume what might be termed a "scared" appearance. The foliage assumes a stiff, erect attitude, but does not show very much rolling of the leaflets, see Figure 23.

B. Varieties with a spreading habit, such as British Queen, Arran Comrade, Majestic, Arran Victory, May Queen, Duke of York, Edzell Blue, Abundance, Epicure and sometimes Arran Banner. When these are affected with Leaf Roll, the general outline of the plant is not very much altered, but the lower leaves soon show severe rolling and this develops later in the top leaves also, see Figure 24.

C. Varieties with a more or less spreading habit, such as Up-to-date, Lochar, Great Scot, Di Vernon and sometimes Arran Banner. In affected plants of these varieties rolling occurs mainly if not only in the lower leaves, the plant does not look very abnormal, though it assumes a more compact form of growth, see Figure 25.

Affected plants in Groups B. and C. may readily be overlooked in a crop with heavy foliage.

Plants which have only quite recently become infected may show no signs whatever of such infection, and this may be the case throughout the remainder of the season. That such plants really carry the virus will become evident in the following season when the symptoms of Leaf Roll will appear in their progeny. It is only when healthy plants become infected comparatively early in the season, or when healthy tubers become infected through their sprouts while the tubers are in boxes, that unmistakable symptoms of Leaf Roll appear in that season.

In order to recognise Leaf Roll particular attention should be given to the lower leaves; with most other diseases and injuries which bring about rolling of the leaves, the young leaves at the top of the plant are the first to show rolling. Verticillium Wilt, Black Leg, Stem Canker and a few other diseases cause rolling of the leaves, more especially the top leaves, mainly due to a shortage of water: in fact any injury to the stem is likely to bring about a rolling of the leaves for the same reason. The old set often remains in the soil quite sound and firm until the crop is ready for lifting. This, however, is not an infallible sign of the disease.

Appearance of Disease on the tuber.—Apart from diminished yield the tubers from a potato plant affected with Leaf Roll show no abnormal symptoms,* and no practical method has so far been discovered by which it is possible to tell whether a tuber is or is not carrying the Leaf Roll virus. This can be discovered only when the tuber is set and the resultant plant examined after it is about one month over ground.

Effects on different varieties.—Leaf Roll has a very serious effect on all varieties, but the effects are more marked on the varieties included in group A. than on those in groups B. and C. The yield is usually reduced in somewhat the same proportion as the parts above ground. In Group A. the yield is generally reduced to 10 per cent. of normal, in group B. the yield is reduced to at least 50 per cent. of normal, while in group C. the reduction amounts to 25 to 50 per cent. of normal

Although the degree of tolerance towards Leaf Roll varies considerably in different varieties, as already indicated, no strictly immune variety is yet known. In Ireland, however, the disease has rarely, if ever, been seen in the field in Epicure, Champion, Buchan Beauty, Great Scot and Shamrock, though it has been found in other varieties in the same field at the same time as those mentioned, and apparently exposed to the same chances of infection.

Transmission and Spread of the Disease.—The virus of Leaf Roll does not occur in the soil or in the air but exists only within

* There is some evidence that the tubers of some varieties in their first year of infection, but not afterwards, exhibit the tuber disease known as Net Necrosis.

Fig. 25.—A potato plant affected with Leaf Roll. Variety, Lochar. (See p. 51.)

Fig. 26.—A potato plant affected with simple mosaic. Variety, Arran Chief. (See p. 54.)

the tissues of affected plants, including the tubers. It is transmitted from a diseased to a healthy plant by the agency of those sucking insects known as aphides or greenfly. It can be transmitted artificially by grafting healthy and diseased plants together, but not by sap injection or other mechanical means. In the store or sprouting box greenfly feeding on the sprouts of affected tubers and then migrating to and feeding on the sprouts of healthy tubers will transmit the virus to the latter, and such tubers will give rise to plants affected with Leaf Roll. In the field, also, greenfly feeding on a single affected plant and then migrating to its healthy neighbours will cause them to become infected. A single affected plant in a crop therefore will serve as an infection-focus when aphides are about. Once infected with Leaf Roll the plant and all its progeny remain infected, for the virus multiplies within the plant. The disease is perpetuated from one season to the next in the tubers. Some of these may by chance not have been dug and removed from the field. They give rise to "groundkeepers", and such plants are dangerous sources from which the disease is transmitted by greenfly to healthy plants. From such plants the insects may fly to considerable distances and reach and infect healthy plants. **Tubers from affected plants invariably give diseased ones,** and by the distribution of affected seed from place to place the disease is spread up and down the country.

Control Measures.—(1) The greatest circumspection should be exercised as to the source from which seed is obtained and every care should be taken to purchase only seed from crops free from Leaf Roll.

(2) Roguing in a crop containing more than a minimum of plants affected with Leaf Roll is practically useless, but in a crop where only a very occasional affected plant occurs this should be carefully dug, placed in a sack, removed and burned. The sooner such plants are dug the better, as infection may soon be spread by greenfly to neighbouring plants. The greatest spread of infection takes place in June or early July.

(3) Good healthy seed should never be planted near a doubtful crop.

(4) The growing of seed potatoes should be confined to districts where Leaf Roll seldom appears. It is now recognised that bleak wind-swept districts with a heavy rainfall and free from long dry periods are the most suitable for seed production, because in them greenfly do not flourish. These conditions exist along almost the whole western coast of Ireland.

DISEASES OF THE MOSAIC TYPE.

The term "Mosaic" has been applied up to quite recently, and indeed is still often applied to cover a number of virus diseases, all of which produce light green areas, irregular in shape, among the naturally darker green of the leaflets, giving rise to a mottled or mosaic appearance. In Aucuba Mosaic the areas are more clearly defined and are more or less bright yellow in colour.

At one time it was thought that only one disease was concerned, which, in its early stages, appeared in a mild form and each year became more marked in its effects. It is now known that this is not so but that there are several distinct diseases that give rise to the mosaic effect. They are all virus diseases, but whilst some of them are due to infection with a single virus others result from a combination of viruses in the same plant.

From the scientific aspect the matter is rather complicated; but from the grower's point of view the position is simple; all forms of Mosaic disease are to be regarded as dangerous and must be eradicated.

The chief diseases of the Mosaic type are as follows:—Aucuba Mosaic, Simple Mosaic, Interveinal Mosaic and Crinkle, and these will now be briefly described.

AUCUBA MOSAIC.—This type of Mosaic was so named from the characteristic bright yellow spotting on the leaves of affected plants which causes a resemblance to the leaves of the variegated laurel *Aucuba japonica*. The yellow spots or patches occur more particularly on the lower and middle leaves and are more or less round and distinct in outline. There is no leaf distortion. Frost can cause symptoms resembling Aucuba Mosaic, but the yellow spots due to frost are more irregular in shape and size, and the leaf usually shows some further injury. Affected plants grow normally and give good yields, so that the disease is not of very great consequence. In the field Aucuba Mosaic rarely appears except on odd plants here and there in the crop, but in the variety Ninetyfold, it is almost universally present to some extent and is sometimes regarded as one of the characteristics of this variety. It also was always present on the old variety Early Regent. The disease does not apparently spread in the field; no insect vector, at any rate, is known. It has been transmitted artificially by grafting, and Clinch found that it was readily transmissible by sap inoculation into President, Majestic, Champion, Epicure, Arran Crest, Great Scot, Dunbar Yeoman, Arran Banner, Arran Victory, British Queen, Up-to-date and Irish Chieftain, in which the characteristic yellow spotting was produced. The virus that causes this disease has been named Virus G. A closely related virus, Virus F, causes externally visible irregular, brown, dead patches on the surfare of the tubers and also dead patches in the pith of some half dozen of the varieties mentioned above.

SIMPLE MOSAIC.—This is the commonest potato virus in Ireland, and is usually marked most definitely by the leaflets being irregularly mottled with light green areas or spots. No extreme dwarfing of the plant occurs, but there is practically always a reduction in the size of the leaflets. There is usually some, though it may be very slight, puckering and wrinkling of the foliage, as can be seen comparing Figures 26 and 31; the former shows only the slightest trace of something being wrong, while the latter is a healthy plant with its broad flat leaflets. In dry seasons and in strong sunshine the mottle is frequently

Fig. 29.—A potato leaf affected with crinkle. Variety, Champion. (See p. 60.)

Fig. 28. A healthy potato leaf. Variety, Champion. (See p. 60.)

Fig. 27.—A potato leaf affected with Simple Mosaic. Variety, Champion. (See p. 60.)

(Reproduced from The Economic Proceedings of the Royal Dublin Society by kind permission).

Fig 30.—A potato plant affected with Crinkle. Variety, Arran Chief. (See p. 55.)

Fig. 31.—**A healthy potato plant. Variety, Arran Chief. Compare with Fig. 30.** (See p. 54.)

Fig. 32.—A potato plant affected with Crinkle and a healthy plant. Variety, Irish Chieftain.
(See p. 55.)

masked, and the only indication of the disease may be that the plants lose their foliage rather early, the leaves dropping off from below upwards. Simple Mosaic is caused by Virus X, but the mode of transmission is still unknown.

The following varieties, when inoculated with Virus X, show a faint to definite mottle with only a slight reduction in vigour:—

Arran Banner	Great Scot
Arran Victory	Kerr's Pink
British Queen	President
Champion	Eclipse
Duke of York	Majestic

INTERVEINAL MOSAIC.—In this disease the mottle is usually more pronounced and the lighter colouring appears to run in bands between the veins. In all respects this disease may be treated as one with Simple Mosaic so far as the grower is concerned. It is due to a combination of two viruses one of which is probably X. Its mode of transmission is also unknown.

Interveinal Mosaic in its typical form can be seen in the following varieties:—

Arran Banner	Duke of York
Arran Victory	Great Scot
British Queen	Kerr's Pink
Champion	Up-to-Date.

CRINKLE.—This disease is well-named as, when present in some varieties, the foliage is so distorted as to make the variety unrecognisable—see Figure 30. There is no distinct spotting as in Simple Mosaic, but diffused, slightly yellowish or light green areas occur all over the foliage. As death approaches this colour becomes more pronounced; rusty brown spots may also appear near the tips of the leaves. The leaflets are markedly reduced in size and are always mis-shapen—see Figures 29 and 32. The whole plant is dwarfed. The leaves drop off prematurely and the plant withers before its usual time. The yield is very seriously reduced and, of course, the progeny carries the disease with it.

This is one of the virus diseases which Murphy and McKay definitely proved to be caused by a combination of at least two viruses. Crinkle symptoms can be produced by a combination of Virus X and Virus A and probably by other combinations. How this disease is spread in the field is not known.

The following varieties, when affected with Crinkle, show severe reduction in size of leaflets with mottling, puckering and wrinkling of foliage, accompanied by stunting of the plant:—

Arran Banner	Irish Chieftain
Arran Victory	Majestic
Arran Consul	President
Champion	

In the following varieties Crinkle produces a very serious effect resulting in the premature death of the plants:—

British Queen	Great Scot
Up-to-Date	

Plants very severely attacked by Crinkle have sometimes been described as affected with *Curly Dwarf*, a term first introduced in the U.S.A. On the other hand, the miserable plants derived from tubers produced by plants affected with Leaf Drop Streak often show this Curly Dwarf condition, so that Curly Dwarf can scarcely be regarded as a disease due to one specific virus.

STREAK DISEASES.

The virus diseases belonging to this group are characterized by the occurrence on the leaves and stalks of affected plants of dark brown or nearly black spots or stripes (hence the name Streak), caused by the death and discolouration of localised parts of the tissues, a feature which is known as " necrosis",* the spots, stripes, etc., being called " necrotic lesions".

Three chief types of Streak are now recognised and may be briefly discussed.

The first described and probably the commonest, as well as the most important, is now known as *Leaf Drop Streak*. This disease is well named as it causes dark streaks on the leaves and stem, and eventually the leaves drop off, see Figure 33. On the topmost leaves a rather indistinct blotchy green mottle first becomes apparent, accompanied usually by some wrinkling or puckering of the leaflets. This condition then occurs in the lower leaves also. For a time the veins on the upper sides of the leaflets appear normal, but on the undersides they turn dark brown, hence brown lines or streaks make their appearance and spread down to the leafstalk. Meanwhile brown spots or blotches (" necrotic lesions") occur in the tissues between the veins, giving the leaf a spotted appearance. The final result is a withering of the leaf; it takes on a " blighted " appearance, falls down and hangs for a time attached to the stalk by a woody thread. These hanging leaves are often blown away by the wind and the lower and middle parts of the stalk are then left bare. Withering and dropping of the leaves takes place by degrees from the bottom of the stalk upwards, but the upper leaves are not generally killed; they remain attached to the top of the stalk and the plant thus takes on what has been described as a "palm tree" appearance, see Figure 33.

The disease in certain varieties is violent, and fairly rapid in development, so that the yield is very seriously reduced. The tubers produced show no abnormal symptoms but they contain the virus, and if planted give rise to miserable plants which show a condition that is well named " Curly Dwarf." See Figure 34. Fortunately this disease is rare in the Irish Free State. No crop would be certified for seed purposes where any

* This word " necrosis " may seem rather out of place in a publication of this kind, but it cannot easily be avoided. It is derived from the Greek, nekros, a dead body, and is used to indicate the death of a certain part of the plant. " Top Necrosis " is a term now frequently used and means the death of the top of the plant. " Foliar Necrosis " signifies the death of leaves. Foliar being derived from the Latin, folium, a leaf.

Fig. 33.—A potato plant affected with Leaf Drop Streak. Variety, Crusader. (See p. 56.)

Fig. 34.—A potato plant showing Curly Dwarf. Variety, Champion.
(See p. 56.)

plants affected with this disease are found in the field. The virus that causes this disease is known as Virus Y, and it is transmitted in the field from diseased to healthy plants by the same species of greenfly, *Myzus persicae*, as that which most commonly transmits Leaf Roll.

Some of the varieties that show Leaf Drop Streak when infected with Virus Y are:—Up-to-Date, President, Majestic, Arran Consul, King George and Duke of York. In Arran Victory, Epicure and Arran Chief this virus does not produce a Streak disease, but merely a mild Mosaic mottle. Di Vernon is a " carrier " of this virus, that is to say, it may contain the virus and yet show no disease symptoms.

TOP NECROSIS.—The second type of Streak disease, though rarely met with in the field, is also exceedingly destructive. It has been called " Top Necrosis " because the top of the plant is first affected. The uppermost leaves become spotted; this is followed by the death of the growing points of the stems and the dying back of the whole plant from above downwards. See Figure 35. The extent and rapidity of the destruction of the plant will vary somewhat according to its age when infection occurs and to the conditions under which it is growing. The grand finale, however, is that the attacked plant is prematurely " wiped out ". Some of the tubers produced by plants affected with Top Necrosis may appear to be quite normal and healthy, but others show dark coloured blotches in the flesh when they are cut. The dead areas usually spread, the eyes become involved and are killed, and after a few months storage the tuber may be reduced to nothing but a corky mass.

Nothing is yet known about the spread of Top Necrosis through insect agency, but it has been proved experimentally that no less than five viruses, all believed to be distinct, can cause Top Necrosis in a number of different varieties of potatoes. Nevertheless each virus does not cause this disease in every variety, and the particular virus concerned may be " carried " in some varieties without any visible symptoms of disease. Thus Virus X, one of the five, is carried by the variety Up-to-Date and some others, but it causes Top Necrosis in Epicure, Arran Crest and certain other varieties. The virus-variety combinations that give rise to Top Necrosis are of considerable complexity, but no useful purpose would be served by entering into further details here. Fortunately this disease is very rare in the Irish Free State, but if it is present in the field the crop cannot be certified for seed purposes.

FOLIAR NECROSIS.—The third type of Streak has only recently become clearly characterized. It has been called Foliar Necrosis because, unike Leaf Drop Streak and Top Necrosis, the necrotic (dead tissue) symptoms occur on the leaves only, the stems and growing points being free from them. The first symptoms seen after artificial inoculation occur on the leaves that occupy an intermediate position on the stem. They consist of greyish spots, soft and damp which give the leaf a wilted

appearance. The spots extend rapidly, and the whole leaf ultimately wilts and falls off. This falling of the leaves spreads upwards and, particularly if the temperature be high, a "Palm tree" effect is produced. The buds on the stems, however, are not killed. The upper leaves afterwards show a blotchy mottle between the veins, whilst hard, black brittle spots appear there and cause the leaflet to be distorted. This mottle and the scattered black necrotic spots are also characteristic of any new foliage that may develop. The tubers from affected plants are small but normal in appearance. When planted they give rise to small plants which mature early and set but few tubers. The leaves are undersized, harsh, brittle and covered with black spots, and in the field often show a definite bronzing, thus producing an effect which has been called "rust," but quite distinct from the "rust" referred to elsewhere.

The particular virus concerned has been called Virus D, but nothing is known as to its natural mode of transmission. Although it causes Foliar Necrosis in some varieties such as President, Arran Victory, Arran Cairn, Arran Comrade, Arran Pilot, British Queen, Kerr's Pink, May Queen, Sharpe's Express and some others, it produces Top Necrosis in Epicure, Arran Crest, King Edward, Majestic, Up-to-Date, Duke of York and some others. Arran Banner, Champion, Eclipse and a few others are "carriers" of Virus D. No crop will be certified for seed purposes that is affected with this disease. Fortunately it is rare.

In the field it is often by no means an easy matter to identify with certainty the various forms of Streak, nor for practical purposes is it necessary. Plants which show black-spotted foliage, dark streaks on the stalks, premature dropping of the leaves, or a general withered and brown appearance should be regarded by the grower as highly dangerous. If the proportion of such plants in a crop is extremely small and they are discovered early, they can be removed and destroyed immediately. If, however, they are allowed to remain until the crop is inspected, the whole field must be rejected.

BOLTERS.

Bolters are included amongst the virus diseases, though the cause of the trouble remains unknown.

A Bolter is a plant which is distinguished from the normal plant by the following features:—

(a) It is much taller, with a more open type of haulm showing more bare stems;
(b) It is much later in ripening, 6 to 8 weeks later in some early varieties.
(c) It produces coarser tubers and usually a heavier crop.
(d) It flowers much more freely, and even in varieties that scarcely ever bloom, such as Sharpe's Express, Snowdrop, King Edward, Bolters will bloom very freely.
(e) The tubers of Bolters always produce Bolters. Bolters of the variety Snowdrop obtained in 1917, are still being grown, and have always produced Bolters.

Fig. 35.—A potato plant showing Top Necrosis. (See p. 57.)

Fig. 36.—Witch's Broom. Typical appearance of affected plant. (See p. 59)

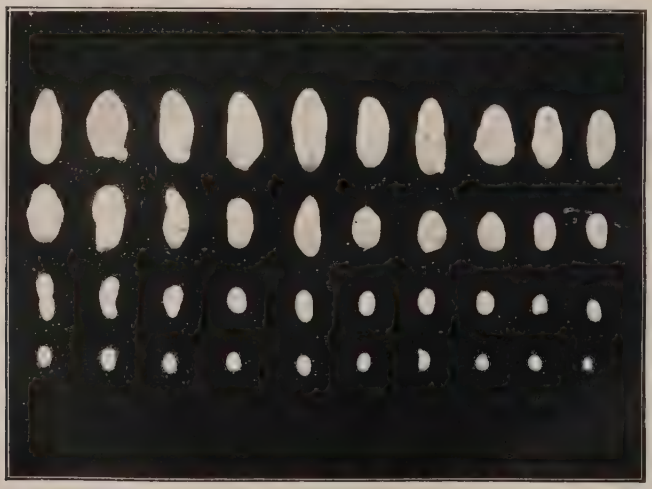

Fig. 37.—Witch's Broom. Produce of plant illustrated in Fig. 36, Total weight, 9 ounces. (See p. 59.)

Bolters are usually not recognisable until well on in the season, when the normal plant has reached its maximum growth. The Bolter continues to grow, and is then easily recognisable by its tall habit and abundance of bloom.

The cause that produces the Bolter is still unknown; it may be the same trouble as is known by the name Giant Hill in America.

Bolters are very objectionable, especially amongst early varieties, and must be treated as "rogues."

Bolters may occur amongst all varieties, but they have been found mainly amongst the following:—Snowdrop, Sharpe's Express, Eclipse, Epicure, Duke of York, Great Scot, British Queen, Ally, King Edward, Arran Chief, Up-to-date.

Bolters must be dug out as soon as they are noticed. Crops containing Bolters will not be certified for seed purposes.

WITCH'S BROOM.

Witch's Broom, a disease first described in America, is considered by Murphy and McKay to present a similar appearance to plants described as "Wildings" in Scotland. As the name Witch's Broom was the first to be used the term Wilding should be dropped. The characteristics associated with Witch's Broom are:—

(a) The plant is very dwarfed, usually less than half the normal height.

(b) A very large number of short stems is produced, hence the name.

(c) The leaves are thin and light green in colour and often consist of only one leaflet. The number of leaflets is always much less than on the normal plant.

(d) The leaflets are round or heart-shaped.

(e) Flowers are seldom produced.

(f) A very large number of small tubers is produced.

(g) The tubers usually sprout early.

Figure 36 illustrates a typical specimen of Witch's Broom, variety King Edward, and Figure 37 shows the produce, total weight 9 ozs., from this plant.

Murphy and McKay proved that the disease is due to a virus, and is transmissible from an affected plant to healthy plants, but how the disease is transmitted in the field is not known.

Tubers from an affected plant will almost invariably produce affected plants in the following year.

Witch's Broom has appeared in the following varieties:—King Edward, Arran Chief, Up-to-Date, Golden Wonder, Langworthy, Sharpe's Express and Majestic. It may, of course, occur in any variety. A condition sometimes occurs in which some stems of the plant are normal, and others show the true Witch's Broom condition.

Affected plants should be dug out clean and burned as soon as they are observed.

VIRUS DISEASES.

INSTRUCTIONS FOR THE GROWER.

While the position is complicated from the scientific point of view, the grower's position is comparatively simple. In the Irish Free State crops will not be certified as suitable for seed purposes unless the whole field is free from Leaf Roll, Crinkle and the Streak diseases. It would be desirable to insist on complete freedom from all virus diseases, but this is not yet practicable. The difficulty arises that, while the symptoms of Leaf Roll, Crinkle and Streak Diseases, once they develop, are always visible, the mottle in Simple Mosaic and Interveinal Mosaic often becomes masked in dry sunny weather, and unless other symptoms are apparent, these two diseases cannot always be discovered. In consequence all that can be done at present in addition. of course, to the elimination of any plants clearly affected with any definitely recognisable virus disease is to have all plants removed that show any of the following symptoms:—

1. Reduction in the size of the leaflets, see Figures 27 and 28.
2. Dwarfing of the whole plant.
3. Puckering and wrinkling of the leaflets with the margins waved, see Figure 29.
4. A more sprawling habit of growth than normal.
5. Premature ripening.
6. Production of less bloom than normal.

BLACK LEG.

This is another disease that could be eliminated and must be eliminated from seed crops. Pethybridge[1] and Murphy wrote in 1911 as follows:—

> " It is perhaps a counsel of perfection to recommend that only those tubers should be used for ' seed ' purposes which can be guaranteed to be the produce of a crop free from Black Stalk-Rot (a name since dropped in favour of the original Black Leg); BUT THE TIME IS NOT FAR DISTANT WHEN IT WILL BE NECESSARY TO PAY MORE ATTENTION TO THE SOURCES OF POTATOES FOR ' SEED ' PURPOSES FROM THE POINT OF VIEW OF THEIR BEING CARRIERS OF DISEASE NOT ONLY IN THE CASE OF BLACK STALK-ROT (BLACK LEG), BUT ALSO IN THAT OF SOME OTHERS, SUCH AS LEAF-ROLL AND CURL."

The time has now come when this disease must be eliminated.

Freedom from Leaf Roll has been a condition for the certification of crops for seed purposes in the Irish Free State since 1925, and freedom from the severe forms of Mosaic has been a condition since 1932. Since 1925 growers have been required to dig out all plants affected with Black Leg. Wherever this has been done thoroughly the crops are now free from this disease. IN THE NEAR FUTURE ALL CROPS WILL BE REJECTED WHEREVER THIS DISEASE IS FOUND IN THEM.

> " This is a bacterial disease which not only destroys the stalks and foliage of the plants, but also causes the tubers to rot. (See Figure 38).

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[1]Pethybridge, G. H., and Murphy, Paul A., A Bacterial Disease of the Potato Plant in Ireland. Proc. Royal of Irish Acad., Vol. XXIX., Sec. B., No. 1, 1911.

Fig. 38. Centre—A single potato stalk in an advanced stage of an attack by Blackleg. Left—An attacked tuber, the organism having entered at the upper (heel) end. Right—Cross section of an affected stem, some distance above ground level; the three principal woody strands opposite the wings are much darkened. *(Reproduced from Leaflet No. 107 of Ministry of Agriculture and Fisheries, London, by permission of the Controller of H.M. Stationery Office, London.)* (See p. 60.)

Fig. 39.—A potato plant badly attacked by the Black Leg disease.
(See p. 62.)

When the investigations at Clifden were started in 1909, the stock of seed tubers was obtained from a crop grown about twenty miles away in a wet boggy field. From this stock during the first season a very large number of plants suffering from Black Stalk Rot (Black Leg) appeared, even when the tubers were planted in fresh land, strongly suggesting that the trouble lay in the seed tubers.

During subsequent seasons the amount of this disease has grown less and less, until in 1912 plants suffering from it were of extreme rarity in the plots, so that it may be said that for practical purposes, the disease has been eliminated, although there has been no change of seed. THIS RESULT HAS BEEN OBTAINED BY THE SIMPLE PROCESS OF GETTING RID OF DISEASED PLANTS, AND BY TAKING STRICT PRECAUTIONS TO PREVENT THE PRODUCE OF SUCH PLANTS FROM GETTING INTO EITHER THE SEED BOXES OR THE PITS. Probably also the result is due to some extent to the good cultivation and manuring which the plots have received. Although, as stated in a previous report, it may occasionally happen that the disease is contracted by healthy plants from the soil, yet the attempts to produce such affected plants by growing them in soil purposely contaminated with the organism has substantially failed, and THE DISEASE, FROM A PRACTICAL POINT OF VIEW, MUST BE LOOKED UPON AS ONE WHICH IS, IN THE MAIN, TRANSMITTED BY TAINTED SEED TUBERS. HENCE THE IMPORTANCE OF SEEING THAT THE SUPPLY OF SEED TUBERS IS OBTAINED FROM CROPS WHERE THE DISEASE IS NON-EXISTENT."[1]

It is true that the produce of a diseased plant is not always diseased, so that Black Leg is not hereditary in the strict sense of the word as is the case with Leaf Roll and other virus diseases, but despite that fact, there is no doubt but that tainted seed from diseased plants should be avoided with the most scrupulous care.

Black Leg makes its appearance in the potato fields earlier in the season than any other disease in this country and it usually occurs here and there on individual plants which stand out clearly as diseased amongst their healthy neighbours. These two facts suggest at any rate that the trouble lies in the " seed " and this to a large extent is actually the case.

A particularly good article on Black Leg was published by Morse[2] in 1917, and from it a considerable amount of information has been taken. Frank, in Germany, in 1897, appears to have been the first writer definitely to connect the Black Leg disease of the potato stem and the accompanying wet rot of the tuber with a bacterial parasite. Appel, also in Germany, published a full account of the disease in 1903 and named the parasite that caused the disease "*Bacillus phytophthorus*." The disease has been found in Germany, Holland, Belgium, France, England, Ireland, U.S.A., Canada, and probably exists in every potato-growing country. If the total amount of loss caused by this disease each year could be estimated, the result would cause very considerable surprise, and more definite steps would be taken to have it eliminated. However, as soon as Irish Free State growers can claim that their seed crops are free from this disease, other countries will be compelled to follow suit, as is happening in the case of the virus diseases.

[1]Pethybridge, G. H. Investigations in Potato Diseases (4th report). Jour. Dept. Agr. & Tech. Inst. for Ireland. Vol. XIII., No. 3. 1913.

[2]Morse, D. J. Studies upon the Blackleg Disease of the Potato. Jour. Agricultural Research, Vol. VIII., No. 3, 1917.

CAUSE OF THE DISEASE.—The disease is due to a minute organism than can be seen only with the aid of a microscope, and was given the name "*Bacillus phytophthorus*."

TIME OF OCCURRENCE.—This disease is one of the first to make its appearance. In some cases the set rots before it has time to sprout; in other cases the sprout is killed before it has time to get above ground; again the young plant may be attacked at any time when it has come above ground. Pethybridge found it to be much more plentiful in a wet cold spring than in a dry season. In 1911, a very dry spring, the disease was hard to find. When this disease kills the set or kills the plant in its very young stages, its presence may escape detection. From about the middle of June onwards the affected plants (see Figure 39) can usually be seen, and the disease may continue to appear throughout practically the whole growing season.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—Black Leg rarely occurs in patches or localized areas; it usually appears on plants scattered here and there over the whole field, showing that the seed is usually the cause of the trouble. All other things being equal, the disease is more likely to occur in wet than in dry soil, and is more prevalent when the early part of the growing season is characterized by abundant rainfall.

APPEARANCE ON FOLIAGE.—(1) Diseased plants are at once evident by the pale green or yellow colour of their foliage and by their stunted and unthrifty appearance.

(2) Later, the leaves become limp and drooping, and the appearance of a plant which has been suffering from this disease, and has reached this drooping stage is shown in Figure 39. Sometimes the attack is at first confined to one stalk only of a plant, but eventually every stalk will succumb.

(3) If a stalk, in a fairly early stage of attack, be pulled out of the ground, it will be found that the portion of it which was below ground is black and more or less soft and rotten. See Figure 38. The roots also will be found to be dead, except perhaps a few near the soil level, so that the plant comes away very easily. Stalks attacked by Black Leg show an inky-black discolouration extending from the base of the stem, where it is attached to the set, up to the surface of the soil, and very frequently 1, 2 or even 3 inches above the ground. In some seasons, under favourable weather conditions, the decay may proceed up the stem for several inches or even pass out to the larger branches, destroying the entire stem. This is more likely to occur when the plants are growing in a moist soil and during periods of moist, cloudy weather.

(4) If the stalk be cut across a few inches above ground level, the triangular section will be seen to show three dark, brownish spots, one at each angle of the section, see Figure 38.

APPEARANCE ON TUBER.—The seed tubers from which diseased plants have grown are invariably found to have been

Fig. 40.—Black Leg.—A tuber borne on a diseased plant showing the point of entry of the disease from the parent plant at the heel. (See p. 63.)

Fig. 41—Black Leg. Interiors of tubers inoculated at their heel ends by stabbing with a pure culture of *Bacillus phytophthorus* showing the characteristic rot in the tubers. (See p. 63.)

Fig. 42.—Black Leg. The left hand stalk was inoculated with *Bacillus phytophthorus* and is beginning to wither. The right hand non-inoculated stalk remains healthy. (See p. 63.)

attacked by a soft wet rot, or may have been destroyed entirely before the examination is made. At this time, and even for some weeks later, the seed pieces or tubers from which surrounding healthy plants have sprung are entirely sound. If young tubers have formed before the plants are destroyed, the disease frequently passes along the stolons (underground stems) upon which the tubers are produced, and infects these also, producing a rapid soft rot, see Figure 40, also Figure 38. This is by no means the invariable rule, as in some cases the new tubers may become infected without immediate rotting being set up. Such tubers will, however, rot in the pit and spread the infection to others round them, or may remain sound until they are planted the following season, when they may produce diseased plants.

EFFECTS ON DIFFERENT VARIETIES.—Pethybridge found in 1909 that Black Leg was more prevalent in some varieties than in others. He found both Irish Queen and British Queen badly affected, Champion decidedly less so. Morse agreed that ' different varieties show a marked difference in their susceptibility to the disease." Indeed, Harrison in Canada, as early as 1906, showed by inoculation tests (See Figures 41 & 42) that differences in ability to resist the attacks of Black Leg are exhibited by quite a number of varieties. Unfortunately no tests have been made regarding the resistance or otherwise of most of the more important commercial varieties now in use. The most serious damage due to Black Leg that the writer has seen was in a crop of Irish Queen grown in a garden near Killybegs about 1910; about 20 per cent of the plants were destroyed. This variety had not been long in cultivation at that time, and several growers believed that the disease tended to disappear after the variety had been some years in cultivation. The only other commercial variety which the writer has seen particularly badly affected with Black Leg was Arran Consul, especially where it was grown from cut sets. Here again the disease does not seem to be nearly so prevalent as it was in the early years of the variety.

SOURCE OF NEW INFECTION EACH SEASON.—A typical case recorded by Pethybridge has already been quoted showing that the seed tubers are the main source of trouble, and not the soil. Another case recorded by Morse may be given:—

> " In 1907 a 4-acre field on the University farm at Orono, Me., where blackleg had not previously appeared, was planted with seed tubers from several different sources. Along one side three barrels of potatoes, each from a different source, were planted. Quite a percentage of diseased plants were found where one of these barrel lots were used, but a careful search several times during the summer failed to reveal any such on the remainder of the field."
>
> " Observations in Maine indicate that under the climatic conditions which exist there, infected seed potatoes are the sole source of infection and distribution and that the disease does not live over the winter in the soil."

Even when the soil at Clifden was strongly dosed with the remains of diseased plants and tubers, Pethybridge was unable to find the disease in the following year on plants grown from sets known to be healthy. The disease was induced to pass, and that rarely, from the soil to the plant only when a plant was grown in a water-logged soil heavily infected with the organism.

Everything points to the fact that if all diseased plants and their tubers are cleared out of a crop, there would be no Black Leg in the following season. This matter will be put to the test on a field scale in the coming season.

Pethybridge[1] recorded the following case in 1910:—" With regard to the occurrence of the disease and to its spread, the evidence clearly shows that this is mainly due to the unsuspected planting of already infected ' seed ' potatoes. An experiment carried out during the past season, was as follows:—A plot half a square perch in extent, was planted with tubers of the variety ' British Premier ' (probably Epicure or Epicure bolters). These particular tubers were derived from a crop grown in 1909, which suffered severely from Black Leg. A considerable portion of the tubers from this crop were rotten, but the apparently sound ones were boxed, and they kept well over the winter. At planting time they showed no external signs of disease, and anyone unacquainted with their origin would have had no scruple in using them for ' seed.' The plot in which they were planted at Clifden received artificials alone, so that infection by means of contaminated dung was excluded. Other ' British Premier ' seed of known healthy origin was grown on adjoining plots and produced perfectly healthy plants; moreover, a bacteriological analysis of the soil of the plot was made, and the Black Leg organism could not be discovered in it, so that infection could not have arisen from the soil. The result of using the apparently healthy tubers derived from a previously diseased crop as ' seed ' was that, during the season, no less than ninety-four per cent of the plants derived from them succumbed to Black Leg. One of the tubers borne by a plant from this plot is illustrated in Figure 40. THIS INDICATES SUFFICIENTLY CLEARLY THE DANGER OF USING SUCH TUBERS FOR ' SEED ' PURPOSES." Morse, commenting on this statement, said that he had never seen anything like what Pethybridge had described, but he agrees that infection does come from tubers from diseased plants.

The organism that causes the disease does not form spores and is not resistant to drying. Further, the disease does not spread from plant to plant in the field.

CONTROL MEASURES.—(1) Dig out as carefully as possible, making sure to remove every tuber of every plant that is affected with Black Leg. To do so it is necessary to examine the crop at least once each week between early June and late August. A thorough clearing in one year would leave little to be done in succeeding years.

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[1]Pethybridge, G.H. Investigations in Potato Diseases (2nd report). Jour. Dept. Agr. & Tech. Inst. for Ireland, Vol XI., No. 3, 1911.

(2) Use seed only, if possible, from crops in which the disease did not occur.

(3) No diseased tubers should be put into the pits. If the tubers in the pits are kept dry the disease will not spread from one tuber to another to anything like the same extent as when the tubers in the pits are wet.

B.—DISEASES THAT APPEAR ON THE TUBER.

Three diseases that attack the tuber as well as the foliage have already been dealt with, viz., Blight, Black Scurf, and Black Leg. The Botrytis disease should also be added to this group, though its effects on the tuber are not of any importance in this country. The diseases now to be dealt with do not, with the exception of Wart Disease attack the foliage.

WART DISEASE OR BLACK SCAB.

This disease which it was thought at one time threatened to exterminate the potato has in some respects proved a real blessing in disguise. Though it was found in England at least as early as 1896, its serious nature and the damage that would result if it became widespread was first pointed out by Professor Potter with material collected in Cheshire in 1900. The disease was recorded in Scotland in 1901, but was not found in Ireland until 1908, when it was discovered in gardens at Kilkeel and at Portavogie, Co. Down.

It was not until 1907 that the disease began to cause any general concern and in that year the Destructive Insects and Pests Act was passed.

In 1908 Gough, an inspector of the then Board of Agriculture and Fisheries, made an inquiry into the nature and extent of the disease. He was informed by two owners of cottage gardens that they could grow clean crops of the variety Snowdrop. By making further inquiries Gough came to the conclusion that Snowdrop, Conquest, Golden Wonder and Langworthy were immune or practically so. A more important and useful discovery has seldom been made. As a result of Gough's report the Board had trials carried out in 1909 on infected land in three counties. All the trials were similar and consisted of :—

(1) Tests of varieties, for immunity or otherwise.

(2) The testing of possible remedies.

Of the latter it may be said at once all failed. Of the varieties tried, the following were free from disease: Langworthy, Golden Wonder, Abundance, Conquest and Snowdrop. The immunity tests were repeated in 1910. The Board did not themselves initiate further experiments at that time, but in 1911 and 1912 experiments were continued at the Harper Adams College.

In 1915 the late John Snell, an Inspector of the Board, started, in conjunction with the Lancashire Farmers' Association, a series of semi-official trials at Ormskirk which later developed into what are now universally known as the Ormskirk Potato Trials.

Wart Disease is widespread in Europe and has been discovered in America.

It is difficult to imagine what the result might have been, had the timely discovery of immunity not been made. Anyone who has ever seen a bad attack of this disease readily admits no steps are too drastic for its extermination.

The disease has had many local names applied to it, showing that growers had at least recognised its existence if not understood its full significance. Such names are "Cauliflower disease", "Black Scab", "Canker", "Stag Head" and others. The name "Wart Disease" is now generally accepted.

CAUSE OF THE DISEASE.—The disease is caused by a fungus known as *Synchytrium endobioticum*. This fungus can certainly attack potatoes when planted after the land has lain eight years in grass, and how much longer would be necessary for the parasite to disappear has never been ascertained, an interval of 15 years was on one occasion found not to exterminate it.

TIME OF OCCURRENCE.—This disease always appears earlier in a damp warm season, when it has been found as early as the 8th June, but as a rule it is not easily found before early July. In very dry seasons its attacks are very much lessened.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—The disease is most likely to be found, like many other diseases in light soil where potatoes are too frequently grown.

APPEARANCE ON FOLIAGE.—The disease does not usually attack the foliage, but where it is very severe lumps of "wart" are frequently found attached to the stems, especially near ground level, see Figure 43. Early in the season these lumps are a green colour if exposed to light or cream coloured if covered by the soil, but later they rot and turn black, hence the name "Black Scab". The "warts" occasionally occur higher up the stems and even on the leaves, but the writer has only once seen this to occur. The roots are never attacked. In this respect Wart Disease is unlike Powdery Scab which occasionally causes *small* galls or wart-like growths on the roots. See Figure 50.

APPEARANCE ON TUBER.—Frequently the whole tuber is not recognisable as such, but is converted into a warted or cauliflower-like mass; more generally the warty growths emanate from the tuber particularly from the region of the eyes. These growths may be very small, or may even be larger than the tuber itself. Any person seeing such warted growths for the first time could not but be impressed by their repulsive appearance—see Figure 43. In bad cases the whole crop may be destroyed. The writer saw 120 yards of one drill of the old variety Black Skerry dug, and the sound produce did not amount to 14 lbs.

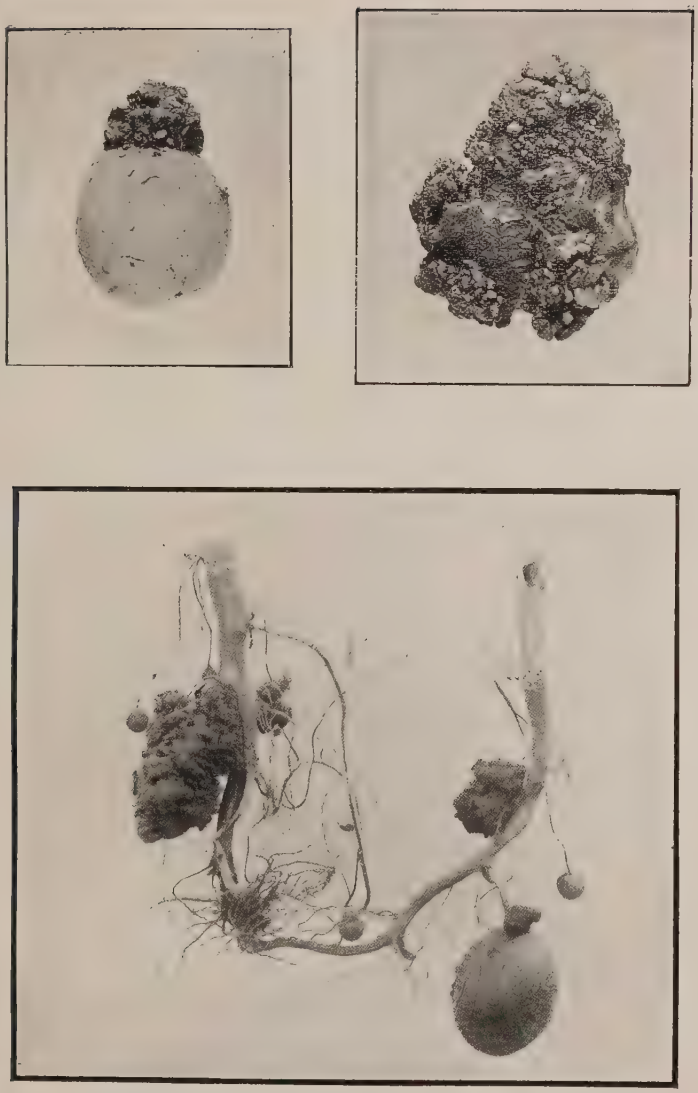

Fig. 43.—Wart Disease. Below—Susceptible variety grown in contaminated soil showing some of the tubers covered with warty outgrowths. Top left—Tuber showing the warty outgrowth produced as a result of the attack of the principal eye at the rose end. Top right—Tuber showing many eyes attacked, and the warty outgrowths spreading and coalescing. (See p. 66.)

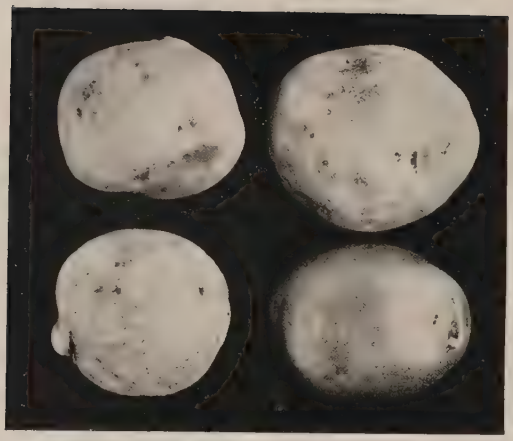

Fig. 44.—Tubers free from scab grown in soil made mechanically irritating by the addition of cinders and subsequently sterilised. (See p. 69.)

Fig. 45.—Common Scab. Tubers grown in a soil similar to those shown in Fig. 44 but not sterilised. (See p. 69.)

EFFECTS ON DIFFERENT VARIETIES.—In practice certain varieties are practically immune, others are susceptible. It was for that reason this disease proved a blessing in disguise. Until the virtue of immunity was discovered the potato variety question was in a hopeless muddle. So-called new varieties were put on the market at high prices only to be discovered later to be old well-known ones with new names. One and the same variety was often known under different names in different districts, and different varieties sometimes passed under one name. Each of the three well-known varieties, Up-to-date, British Queen and Sutton's Abundance, had at least one hundred different names.

When immunity from Wart disease became a vital question for a given variety the systematic naming of varietes followed as a matter of course. Excellent suggestions had long ago been made by Anderson[1] for distinguishing potato varieties from each other, but he was more than a century in advance of his time, and his proposals were forgotten. Blight, in its time, forced the giving of a certain amount of attention to resistant varieties, but it was left to Wart Disease to compel growers to look for pure seed and varieties true to name.

The whole system of inspection of growing crops for purity arose from the discovery that certain varieties are immune from Wart Disease. The inspection system in the Irish Free State has since been extended to cover freedom from virus diseases, Black Leg, etc., as well as purity and vigour of the crop.

A further advance was made in 1920 when a Potato Synonym Committee was established by the National Institute of Agricultural Botany. It is the duty of this Committee to examine every variety sent to the Ormskirk Station and decide whether it is a new variety or only an old variety under a new name. The reports of this Committee are published in the Institute's Journal.

Another series of trials were begun at Ormskirk in 1916. The Earl of Derby undertook to offer a Gold Medal each season for the best new immune variety of the season as judged from the results obtained in the Ormskirk trials. With one exception, Doon Star, all of the most outstanding immune varieties introduced since 1916 have been awarded Lord Derby Gold Medals.

It is, of course, inevitable that on the results of trials necessarily limited in extent awards have been made to varieties that failed to fulfil their early promise. This refers to commercial value and not to immunity, for no variety so far approved as immune has been found to have lost this essential and inherent characteristic. A list of the varieties to which these medals have been awarded is given on page 122.

Immunity tests and yield trials have also been carried on by the Department of Agriculture for Scotland since 1921. The field immunity tests were discontinued after 1934, and laboratory and pot tests substituted. In the yield trials new immune varieties

[1]Anderson, Dr. James. Of the Marks for distinguishing different sorts of Potatoes from each other:—its Utility, etc. Bath and West of England Society, Letters and Papers, Vol. IV., 1792.

are tested against well-known commercial varieties for which they might be substituted. The tests are continued for three years. If a variety is considered satisfactory it is registered. A list of the varieties that have been registered is given on page 123. Despite the elaborate test the varieties are put through, a few of those registered have failed to establish themselves on a commercial footing. At the same time, with the possible exception of Doon Star, no useful variety has been passed over.

It will be noted that in the pages descriptive of the characteristics of the different varieties, it is recorded in the case of each variety, whether it is immune from or susceptible to Wart Disease.

SOURCE OF NEW INFECTION EACH SEASON.—If any person were foolish enough to plant affected seed, the disease would assuredly be reproduced. Apart from diseased seed, the disease arises from the soil or may be from contaminated dung put into it.

As already noted, the fungus that causes the disease can remain active in infected soil for fifteen years and probably longer. Indeed, no case of the natural dying out of the parasite from contaminated soil has as yet been encountered.

Soil moved from an infected field to clean land is almost certain to transfer the disease.

Contaminated soil may be moved adhering to potato tubers, cabbage plants, turnips or other roots, farm implements, horses' feet, workers' boots, etc. Manure containing affected tubers, sweepings of potato houses, movement of tubers by birds, etc., are all important sources from which spread of the disease may occur.

CONTROL MEASURES.—No country has so far succeeded in controlling this disease except by the one method of planting only immune varieties, and every effort should be made to substitute immune for susceptible varieties. So far, however, satisfactory immune substitutes have not been found to replace British Queen and Epicure for home markets, and Up-to-date, King Edward, Royal Kidney, Sharpe's Express, Duke of York, and Ninetyfold for the export trade. A number of promising new immune varieties is at present on trial. Soil sterilization, a very difficult problem on a field scale has been the subject of much experimentation in several countries, but really practical results have not yet been obtained.

COMMON SCAB.

In this country the idea is widespread that a scabby tuber always cooks dry and floury and is good for the table. The assumption is, no doubt, often correct, as Common Scab is most likely to appear on tubers grown in light dry soils, but it is certainly not always true, as witness Arran Crest, a potato of very inferior quality and the most liable of all varieties to be scabbed.

The ordinary grower of ware potatoes in this country has usually regarded Common Scab as a disease of little or no consequence, but the grower of seed potatoes is compelled to give it his serious attention as buyers now demand freedom, or at least a considerable degree of freedom, from Common Scab. Another form of Scab known as "Powdery Scab" is described later. Though the injury caused by these two diseases is sometimes indistinguishable without the aid of a microscope, Common Scob never develops a "canker" form as Powdery Scab does under certain circumstances. The two diseases are alike in one respect, that both are greatly aggravated by an application of lime. Unless there are some very good reasons to the contrary lime should be avoided by the seed potato grower.

CAUSE OF THE DISEASE.—For many years the disease was thought to be due to mechanical irritation, such as would be caused by large quantities of ashes or other sharp material in the soil, but it has been definitely proved that such is not the case, and that the disease is due to the attack of certain micro-organisms belonging to a group known as the Actinomycetes. The fact that the scabs are due to an organism and not to mechanical irritation is admirably demonstrated by Figures 44 and 45. The tubers were raised in an artificial soil made up mainly of cinders to which a small quantity of soil from a field which had produced scabby tubers was added. The portion from which the scabby tubers shown in Figure 45 came was untreated, while the portion from which the clean tubers came had been sterilised by steam under high pressure before the parent tubers were planted. At one time it was supposed that all Common Scab was caused by a single species of the genus and to this the name *Actinomyces scabies* was given; but recent research has shown that more than one species may attack the potato. This fact probably accounts for the varying forms of the scabs themselves.

TIME OF OCCURRENCE.—If looked for, the trouble may be seen almost as soon as the tubers are formed, or at any time during the growing period, but it is usually not revealed, of course, until the crop is dug. When the tuber has completed its growth and is separated from its parent plant, the production of scabs ceases.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—Scab organisms are found in most soils, but especially in those of a dry sandy and gravelly nature poor in humus matter, and soils to which large amounts of lime have been applied. It has been well demonstrated that Common Scab is much less in evidence after a wet season such as 1936 than after a dry one such as 1933 or 1934. The disease is absent from some bog soils which are of an acid nature.

APPEARANCE ON THE TUBER.—Four tubers affected with this well-known trouble are illustrated in Figure 46.

When the tubers are freshly dug the Scab organism can often be seen producing a faint white powdery appearance over the scab spot, but this soon disappears on drying. The small brownish spots which later enlarge into rough brownish patches are well known to every potato-grower and scarcely need further description here. It may be mentioned, however, that these brown patches do not contain a brownish powder such as occurs in Powdery Scab.

EFFECTS ON DIFFERENT VARIETIES.—That some varieties are much less affected than others is certain and has been repeatedly commented upon by Potato Inspectors in this country. The most resistant, though by no means immune, among common varieties have been found to be King Edward, Arran Banner, Golden Wonder and Arran Pilot, while the most susceptible are Arran Crest, Majestic and Up-to-Date. Seed potatoes are rejected and cannot be sold in sealed bags if affected to any serious extent with Common Scab. A reasonably clean crop of King Edward or Arran Banner could be grown in land in which Majestic or Up-to-Date would be useless for seed purposes on account of Common Scab.

SOURCE OF NEW INFECTION EACH SEASON.—The new crop may become infected from the soil, from scabby seed or from contaminated manure.

CONTROL MEASURES. -It is as well to state, definitely, that so far there are no control measures satisfactory under all conditions. A cheap and thorough soil disinfectant is urgently required. Experiments[1] recently carried out in Northern Ireland indicate that certain measures can be taken which will be effective under some conditions. It would appear that satisfactory control of Common Scab may be obtained by the disinfection of seed tubers before planting, provided that an interval of four years or upwards has elapsed between two successive potato crops. Time alone, however, between two potato crops seemingly will not eliminate scab, cereal crops seem to help to reduce its amount.

Tuber disinfection cannot be employed as a successful control measure when potatoes are to be grown in land which has produced a scabbed crop in the previous season. Disinfection of the seed tuber is a valuable control measure in that it prevents clean soil or soil in which the disease is almost extinct, from being re-inoculated.

It was found that the planting of tubers slightly affected with Common Scab may give rise to a severe attack in the resultant crop.

The most satisfactory method for the farmer's use was found to consist of the instantaneous dipping of the tubers in solutions of proprietary organic mercurials. Potato Inspectors can supply

[1]Cairns, H., Greeves, T. N., and Muskett, A. E. The Control of Common Scab, Annals of App. Biology, Vol. XXIII., No. 4, 1936.

Fig. 46.—Four tubers affected in varying degrees with Common Scab.
(See p. 69.)

Fig. 47.—A potato tuber showing the small circular scab spots characteristic of a mild attack of Powdery Scab. (See p. 72.)

particulars regarding these materials. Apart from the dipping of the seed the following measures may be adopted:—

(1) In land slightly infected a variety that possesses some degree of resistance should be grown, viz., King Edward, Arran Banner, Arran Pilot; while Arran Crest, Majestic and Up-to-Date should be avoided.

(2) The application of lime, ashes and soot should be avoided.

(3) The use of Sulphate of Ammonia and Superphosphate tend to minimize the disease, or at least they will not aggravate it. Basic Slag should not be used for potatoes.

(4) Scabbed seed should be avoided as far as possible.

(5) Badly scabbed tubers should be boiled and neither they nor their skins should ever be thrown into the manure heap.

POWDERY SCAB.

This disease has attracted more attention in recent years in this country since the sale of seed potatoes has become an industry of some importance. This form of Scab in its mild or spot form was of such minor practical importance that it passed unnoticed by the ordinary grower, but in future, growers must take notice of it, as buyers of seed in many countries insist on the tubers they purchase being free or at least reasonably free from this disease.

Seed potato growers have already learned of the losses incurred by having to discard tubers affected by Common Scab and Powdery Scab and every effort possible must be made to diminish their prevalence.

Powdery Scab, formerly known as Corky Scab, was noticed by Johnson[1] in 1907 in the Dingle peninsula. He also found the disease very severe on Scotch Champions sent from Perthshire for seed purposes in the same year. Records of the disease on the Continent go back as far as 1841 and its existence in England was known as early as 1846.

CAUSE OF THE DISEASE. The disease is caused by a fungus now known as *Spongospora Subterranea* (Wallr.) Lagerh. Its two most common local names are Powdery Scab and Corky Scab, the former is much to be preferred, on account of the powdery form of the spores (really spore-balls) which form on the scabby portions.

TIME OF ITS OCCURRENCE.—The disease sometimes appears almost as soon as the tubers are formed, at other times it comes later, but as with Common Scab, its presence is not discerned until the crop is dug.

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[1]Johnson, T., D.Sc. Spongospora Solani, Brunch (Corky Scab). Econ. Proc. Royal Dublin Soc., Vol. 1., Part 12, April, 1908.

WHERE THE DISEASE IS MOST LIKELY TO OCCUR.—In this country Powdery Scab is mostly found in a wet low lying part of the field. Where such spots badly affected with the disease occur the tubers should be dug and kept by themselves to avoid having to pick them out later on. The prevalence of the disease is greatly aggravated by the too frequent growing of potatoes in the same ground—another case for the adoption of a good rotation. It is also aggravated by the application of lime.

APPEARANCE ON TUBER.—(1) Powdery Scab assumes a variety of forms on the tuber, some of which are easy and some difficult (and without the aid of a microscope impossible) to distinguish with certainty from Common Scab.

(2) The most characteristic feature of it is the production of a spot or scab of varying size on the skin, and which on very close examination, particularly with a good pocket lens, is seen to contain brownish, snuff-like powdery material, easily rubbed off, and consisting of balls of spores of the organism. Each little grain of powder is a single "spore-ball" and is composed of numerous spores bound together into a minute sponge-like mass.

In its early stages the attack generally takes the form of small isolated pimples on the potato skin, later on these burst, and the spore-balls are exposed.

A tuber showing a mild attack is illustrated in Figure 47.

The scab spots may remain small, and are usually circular in outline and may easily be mistaken for Common Scab.

(3) The attack may, however, be much more severe as is shown by the six tubers in Figure 48. Here the name "scab" is scarcely descriptive of the condition of affairs, the characters resembling those of a "canker" or eating away of the tissues of the tubers. The "canker" form is frequently seen on portions of second-growth attached to a large tuber. This condition might, perhaps, be mistaken for the more serious Wart Disease, and where any doubt exists an expert should be consulted. Under the microscope the spore-balls of *Spongospora* are entirely different from the resting sporangia of the Wart Disease organism.

(4) There are all degrees of transition between the severe "canker" form and the small spots on the surface of the tuber, which may sometimes resemble wart-like outgrowths, see Figure 49.

(5) In addition to its various forms of attack on the tubers, the Powdery Scab organism sometimes attacks the underground stolons on which the tubers are borne, while attacks on the sprouts of unplanted seed tubers have occasionally been seen. Here again small cankery spots are produced which contain the very characteristic spore-balls. Finally this organism very often infects the roots of potato plants causing them to produce small whitish warty bodies or nodules, see Figure 50 which are somewhat reminiscent of the bacterial nodules found on the roots of

Fig. 48.—Powdery Scab. Six potato tubers suffering from a severe attack of Powdery Scab. (See p. 72.)

Fig. 49.—Two young potato tubers showing the small dwarf-like outgrowths caused by Powdery Scab. (See p. 72.)

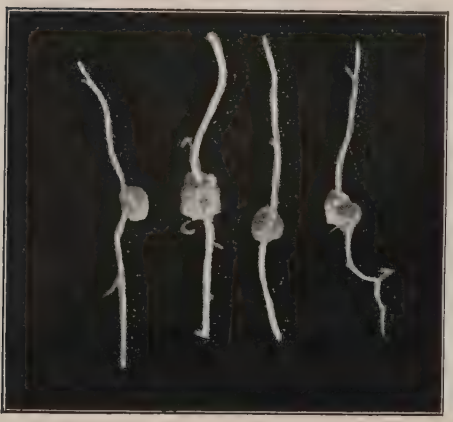

Fig. 50.—Portions of potato roots with Powdery Scab galls on them (about natural size). (See p. 72).

clovers and other leguminous plants. When ripe these little root-warts break down into a powdery mass of spore-balls which remain in the soil to infect future potato plants grown in it. These little warts, it may be repeated here, have nothing to do with Wart Disease, although they have sometimes wrongly been ascribed to it. Wart Disease does not attack potato roots.

EFFECTS ON DIFFERENT VARIETIES.—Pethybridge tested ten varieties for four years in succession and came to the conclusion that among the varieties tested there is not one which shows any distinct or constant tendency to resist Powdery Scab.

SOURCE OF NEW INFECTION EACH SEASON.—The disease is perpetuated either by the planting of affected tubers or by planting tubers in contaminated land, as well as, in all probability, in some cases by the use of contaminated dung.

CONTROL MEASURES.—(1) The disease is undoubtedly most prevalent where potatoes are grown too frequently in the same field, so that here again a good rotation will help. The disease can survive in the soil for at least three years and probably longer.

(2) The disease is always worse in wet seasons and in wet soils.

(3) Diseased tubers especially those showing the Canker form of attack should be boiled and not thrown into the manure heap.

(4) Tubers substantially affected with Powdery Scab should not be used for seed.

In Great Britain under the Sale of Diseased Plants Order, 1927, potatoes substantially affected with Powdery Scab may not be sold for planting.

(5) Good results were obtained by Pethybridge at Clifden in suppressing this form of Scab by the application of Flowers of Sulphur at the rate of 6½ cwts. per statute acre.

In Leaflet 99 of the Ministry of Agriculture and Fisheries, London, it is stated that "Slightly affected unsprouted seed tubers can be disinfected by steeping them for 3 hours in a weak solution of formaldehyde (40 per cent. formalin) 1 pint to 30 gallons water." Moistening the tubers and rolling them in finely divided sulphur before planting in clean land, has also been found effective in checking the disease.

DRY ROT.

This is an old disease though the exact cause of it was for a considerable time a matter of uncertainty. It is unfortunately only too well known to potato growers especially to those who are concerned with certain early varieties.

It is a storage rot which becomes visible chiefly during the winter and spring months in stored or boxed potatoes. It is not evident, like the rot due to Blight and some other diseases—

at the time of lifting the crop although there is very strong reason to believe that primary infection occurs at that time but does not make immediate headway.

CAUSE OF THE DISEASE.—The disease is caused by a fungus known as *Fusarium caeruleum*, a species which attacks the tubers only and does not infect the stalk and cause wilting of the foliage as certain allied species of Fusarium in America and elsewhere do.

TIME OF OCCURRENCE.—The disease usually appears amongst tubers in storage in December and becomes more and more in evidence as the spring advances.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—Dry Rot occurs most frequently on tubers that have been damaged at the time of digging and are then placed in sprouting boxes. Mechanical damage occurring during handling and transit also leads to attack. Two rather remarkable observations have been communicated to the writer that concern this disease, and these observations may at some time be made the subject of scientific inquiry. Growers of the variety May Queen in the Athlone area bring their seed to be dressed over a grader in the merchant's store. A certain number of over-sized, mis-shapen and cut tubers are rejected and taken home by the growers who say that if they keep these potatoes in the sacks they will remain sound until planting time, whereas if they re-pit them or box them they become affected with Dry Rot. Again, potato growers in County Down put no covering on their potato pits except soil. These growers state that if they first cover the potatoes with straw, bracken or ditch cleanings and then cover this with soil more loss from Dry Rot will follow than if covered with soil only.

This disease is certainly more prevalent on potatoes in sprouting boxes than in those in pits.

APPEARANCE ON TUBER.—Six tubers affected with this disease are shown in Figure 51. Its appearance is familiar to potato growers. At first there is at the affected spot a darkening and a sinking inwards of the skin. Later the skin becomes wrinkled or folded, and *whitish fungus pustules break out through it*. If during the period of rotting the tuber has been exposed to a good light the pustules may be pinkish in colour.

If the outer parts of the mature pustules be rubbed away, *the inner parts will be found to be bluish.*

If such tubers as are shown in Figure 51 be cut open it will be found that the internal diseased tissues are brown in colour, dryish, and frequently show cavities in which the white or bluish mycelium of the fungus often grows luxuriantly.

As the process of rotting goes on, the tubers lose more and more water and hence become lighter, and, finally, they are reduced to a completely dry hard mass difficult to cut with a knife.

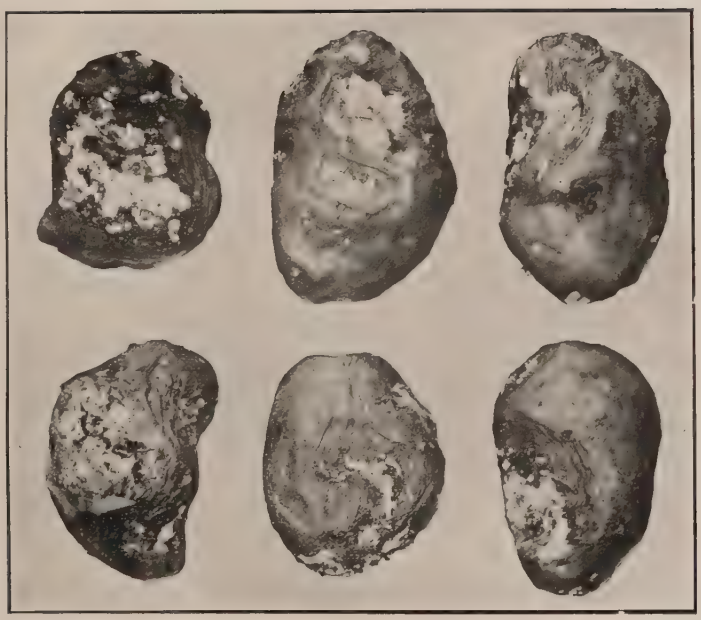

Fig. 51. **Six tubers affected with the Dry Rot disease due to** *Fusarium caeruleum*. **External appearance.** (See p. 74.)

Fig. 52. Tubers affected with "Skin Spot" caused by the fungus *Oospora pustulans*.
(See p. 76.)

If the attack begins late in the season, the tubers often sprout in the ordinary way, but if such tubers are planted under unfavourable conditions, the disease often succeeds in completely rotting the set, before the young plant can establish itself independently.

In this way blanks are often caused.

Dry Rot may start anywhere on the tuber, it does not necesarily begin at the heel or stem end as with Black Leg. The Rot however practically always starts at a wound, hence the necessity for keeping seed tubers free from injury. Pethybridge established an interesting relation between the degree of maturity of the tuber and its susceptibility to Dry Rot. As a rule tubers are more resistant to infection with Dry Rot the less mature they are. It is particularly when tubers are approaching the period at which the buds in their eyes begin to sprout that they are most susceptible to infection, and this explains why it is that complaints of losses due to Dry Rot are more frequent in the spring than in the autumn.

EFFECTS ON DIFFERENT VARIETIES.—Some varieties are so liable to this disease that in order to protect themselves sellers should stipulate that complaints cannot be considered except within seven days of the date of delivery. Such varieties are May Queen, Ninetyfold, Di Vernon and Catriona. In certain seasons these varieties will keep perfectly, while in others for no apparent reason, up to 90 per cent. may develop Dry Rot in the sprouting boxes. Sharpe's Express, Dargill Early, Arran Pilot, Arran Comrade, Ruby Queen and Majestic are sometimes badly affected.

SOURCE OF NEW INFECTION EACH SEASON.—Pethybridge clearly proved in 1908 that living spores of the fungus were present upon the walls and floor of a loft in which seed tubers badly affected with Dry Rot had been stored. It was further proved that the spores were also present in the air of this loft and that tubers with their cut surfaces exposed to this air became infected with the disease. This shows that the spores are highly resistant to dry conditions.

Further studies on the exact time and mode of infection of the tubers are urgently required, but present knowledge would suggest that the fungus is most likely an inhabitant of the soil and can persist in it for a long time. Primary infection probably occurs mainly at the time of digging through wounds and abrasions of the skin made by the implements used, the source of infection being the soil. Secondary infection can readily occur, especially following rough handling and damage during transit, from the spores produced by the pustules resulting from primary infection.

CONTROL MEASURES.—(1) The greatest care should be exercised in digging seed potatoes, especially of early varieties, so as to avoid all possible injury to the skin or flesh. If seed potatoes were treated with as much care as eggs there would be far fewer complaints of Dry Rot.

(2) Growers should periodically examine their boxed seed and carefully remove all tubers showing Dry Rot, or, indeed, any other disease. If not too rotten the diseased tubers can be boiled and used for feeding purposes; otherwise they should be destroyed by burning or other suitable treatment which will kill the fungus and its spores.

(3) When an attack has occurred in a store the boxes and the whole interior of the store including shelves, etc., if any, should be thoroughly sprayed with a solution of copper sulphate, 8 lbs. in 40 gallons of water, before potatoes are again placed in it. The sprouting boxes themselves should be similarly treated.

(4) Varieties such as Ninetyfold should be packed for transit in barrels or cases, and not in bags.

(5) Ninetyfold, May Queen, Arran Pilot, Catriona, etc., should be purchased early, boxed and well exposed to light. The store should always be cool and well lighted.

SKIN SPOT.

This is a disease that does not cause much more than a blemish on ware potatoes, but is a serious one in seed potatoes. Its seriousness lies in the fact that it frequently "blinds" the eyes and prevents sprouting. The disease appears to be on the increase, and in recent years has become probably the most important factor leading to "misses" and even crop failure in England.

CAUSE OF THE DISEASE.—This disease is caused by the fungus known as *Oospora pustulans*.

TIME OF OCCURRENCE.—This disease is scarcely noticeable at digging time, but the spots become evident during storage and are usually to be seen in January. It develops readily in the pits, but not quite so readily under dry conditions in sprouting boxes.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—So little is as yet known about this disease that it is not possible to say under what conditions it thrives best. The writer never saw this disease present to any extent in Ireland until February, 1936, although its existence was reported here by Pethybridge as long ago as 1914.

APPEARANCE ON TUBER.—Three tubers badly affected with this disease are shown in Figure 52. The disease produces small spots or pimples over the surface of the tubers. These spots usually have a depressed ring on the outside with a raised centre. The spots may be so close together that they merge and then may cover a considerable area. A noteworthy fact in connection with this disease is the ease with which the entire scab or spot may be picked out. If removed with a needle point,

a white socket of sound potato tissue is usually left behind. The fungus is confined to the surface layers of the tuber, and as the spots are so superficial there is little extra waste in peeling the tuber. For this reason and the fact that it never causes rotting of the tuber, it is not regarded as a serious disease by the ordinary grower.

Nevertheless under certain conditions the fungus may kill every bud in every eye and ultimately the "blind" set may be found at digging time quite sound and firm. Instead of producing a plant it may, however, produce a single hard warty growth at the heel end that could easily be mistaken for Wart Disease. See Figure 53.

EFFECTS ON DIFFERENT VARIETIES.—The spot assumes a slightly different form according to the variety of potato on which it occurs. In the course-skinned varieties such as Golden Wonder definite pimples are developed, which when wetted become darker brown than the skin. In the smooth-skinned varieties such as Arran Banner, the diseased spots are scarcely raised, but consist of small, dark, circular spots with slightly raised centres, the areas being brown or black in colour. Arran Consul appears to be less commonly affected than Arran Banner, King Edward and Majestic are often very badly affected in Great Britain.

SOURCE OF NEW INFECTION EACH SEASON.—The life history of the fungus is not fully known, but it is practically certain that the tubers become infected from the soil.

CONTROL MEASURES.—No control measures have as yet been discovered, the only advice that can be given is to follow a good rotation and avoid planting tubers affected with Skin Spot. Seed should always be boxed and sprouted; if any "blind" tubers are noticed they can be removed. Sprouting should always be done in a bright, airy house, and should be a universal practice.

PINK ROT.

This disease was first recognised and described in 1909 in Ireland by Pethybridge although it had doubtless existed long before that. It is a serious disease only for those who grow potatoes too frequently in the same soil, and could easily be eliminated by the adoption of a good rotation.

CAUSE OF THE DISEASE.—It is caused by a fungus named *Phytophthora erythroseptica*, a species closely allied to the Blight fungus.

TIME OF OCCURRENCE.—The rot affects the tubers while they are still in the ground, and it is as a rule rather the larger and older tubers which are found to be attacked. The disease has been found in some varieties as early as July, but the overground effects usually do not appear until August.

WHERE THE DISEASE IS MOST LIKELY TO OCCUR.—This disease is not likely to cause any serious damage except on land where potatoes are too frequently grown. It has been proved that in land which has been contaminated by burying in it tubers affected with this rot the succeeding crop of tubers is specially liable to be attacked.

APPEARANCE ON FOLIAGE.—When the fungus attacks the parts of the stalk below ground, the resulting disease is of the "wilt" type and the symptoms of it (which begin to be appreciable as a rule somewhat late in the season) are somewhat similar to those of the Black Leg disease. The foliage of affected plants, from about the middle of August onwards, becomes pale green or even yellow in colour, while the margins of many of the leaflets, especially of the younger leaves, become rolled upwards and inwards ultimately turning brown, dry and crisp. Areas of dry, brown dead tissue occur scattered over many of the leaflets and their margins are affected in the same way; such symptoms, however, are not necessarily confined to plants affected with this disease. Very frequently, close to the surface of the soil there is a more or less conspicuous crop of small aerial tubers. If such affected stalks be pulled up their underground portions will be found to be more or less rotten, and the same is the case with some of the roots, rhizomes and tubers. The stem is not however so black and rotten as in Black Leg.

APPEARANCE ON TUBER.—(1) This form of rot cannot be described as either wet or dry, it takes rather a middle position between these two extremes. The dead tissues do not become pulpy, and the diseased tuber although by no means so hard as a healthy one, is yet firm and more or less elastic. If severely squeezed a watery liquid is exuded.

(2) The rot almost invariably originates at the heel end of the tuber and spreads more or less rapidly to the rose end—see Figure 54.

(3) When cut open a partially diseased tuber shows at first no sharp line of demarcation between the healthy and attacked portions of the tissues, but the cut surface of the diseased portion rapidly assumes, owing to contact with the air, a *pink* tinge, which, after a lapse of some hours, changes to a velvety brown or almost black colour—see Figure 55.

(4) Dead portions of the underground stems frequently remain attached to affected tubers, see Figure 54.

(5) A certain amount of an acid liquid is exuded through the skin from the diseased portion of a tuber, which causes particles of the surrounding soil to adhere more or less tenaciously to its surface.

(6) The skin itself on the diseased portions is, as a rule, but loosely attached, and can be peeled off somewhat easily. Affected tubers possess a faint, but somewhat pungent odour.

(7) An experiment was carried out by Pethybridge to ascertain whether the rot could be transferred from diseased to healthy

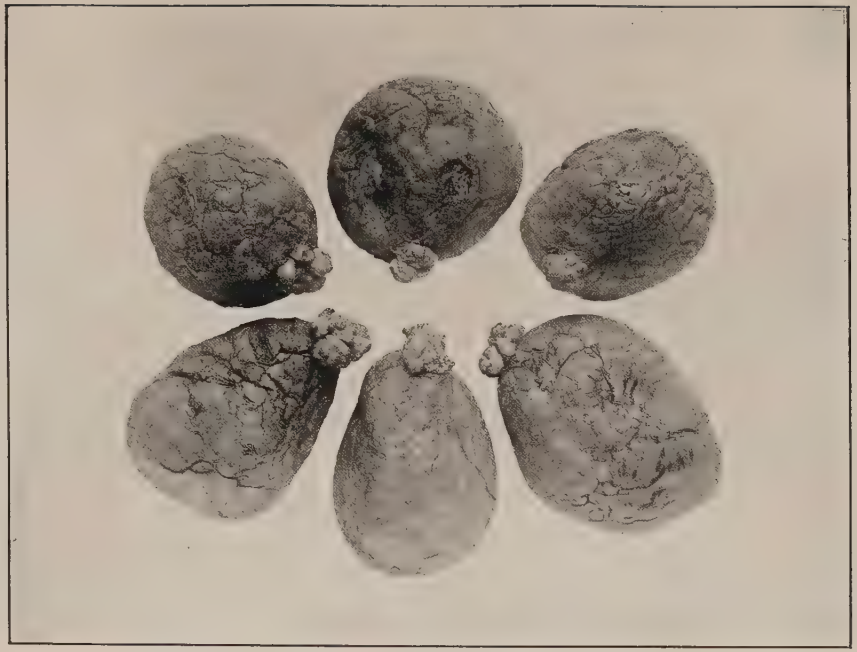

Fig. 53.—" Sets " which failed to produce plants, but instead produced small wart-like outgrowths that might be mistaken for Wart disease. *(Reproduced by permission of the Controller, H. M. Stationery Office, London, from Advisory Leaflet No. 279 of the Ministry of Agriculture and Fisheries.)* *(See p. 77.)*

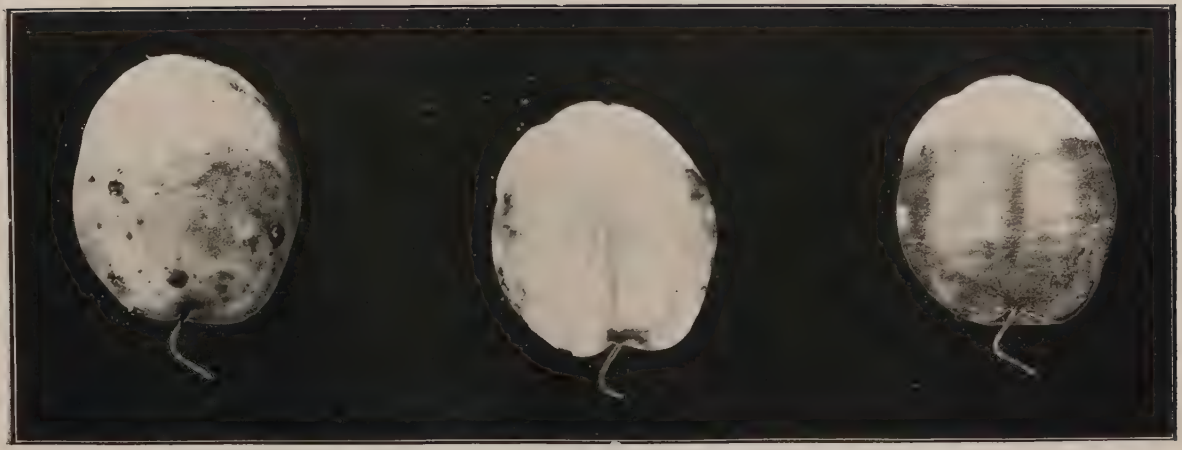

Fig. 54.—" Pink Rot." A tuber in which the lower two-thirds are affected with the disease. (See p. 78.)

Fig. 55.—" Pink Rot." Section of tuber shown in Fig 54, as seen just after cutting and same section with diseased portion blackened by exposure to air for twenty-four hours. (See p. 78.)

tubers in the pit, but although healthy tubers were placed in close contact with diseased tubers from October to January, the healthy ones remained perfectly sound. Fortunately, therefore, the rot does not appear to be communicable from tuber to tuber in the pit, and in this respect too, it differs from Black Leg.

(8) The rot runs its course so rapidly in affected tubers that they are completely killed by it long before the planting period arrives again.

(9) It must not be assumed that the development of a pink colour on cutting a tuber and exposing it to light is a sure sign of Pink Rot. In some cases a perfectly healthy tuber will develop a pink colour when cut and exposed to light. Every tuber of the variety Epicure develops a pink colour in the skin when exposed to light. Moreover a pink colouration of the flesh sometimes develops in tubers attacked by Black Leg. The rot due to Black Leg however is easily distinguished from Pink Rot. In Black Leg the tubers become reduced to a semi-liquid mass, and cavities are often produced in the tuber. In Pink Rot the tissues remain compact and no cavities are formed.

EFFECTS ON DIFFERENT VARIETIES.—Like all other diseases Pink Rot affects some varieties more severely than others. Sufficient information is not available to classify the principal commercial varieties, but Great Scot and King Edward are known to be very susceptible, while Kerr's Pink and Majestic are decidedly more resistant.

SOURCE OF NEW INFECTION EACH SEASON.—There are two kinds of spores produced in the underground parts of an affected plant, the most important being thick-walled resting spores. On the decay of the diseased tubers and other diseased portions of the plant, these spores remain in the soil to infect the next potato crop. Tubers once attacked soon rot, so that there is little danger of this disease being carried by the seed, except in so far as spores in contaminated soil might adhere to the outside of the tubers.

It was definitely proved at Clifden that the disease is directly contracted from the soil.

CONTROL MEASURES.—To avoid this disease, potatoes should be grown only in proper rotation, and all affected parts of the plants, including the diseased tubers should be removed from the land and burned, as otherwise they are a source of contamination. It is necessary to note that the organism responsible for this rot is easily able to survive for four years in land sown down to grass.

SILVER SCURF.

This disease causes little more than a blemish on the skin and is disregarded by all growers except those who grow tubers for exhibition purposes. It has not caused any serious injury to potatoes in Ireland, where its presence was first recorded by Johnson in 1903. Doubtless it had been present here many years before then, as it is so common wherever potatoes are grown.

CAUSE OF THE DISEASE.—The name of the organism, *Spondylocladium atrovirens*, responsible for the disease is more formidable than the actual damage done to the tubers.

TIME OF APPEARANCE.—This disease is seldom noticed until the potatoes have been stored for some time.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—This trouble occurs on all types of soil, peat, loam, clay and sand.

APPEARANCE ON TUBER.—In its early stages the disease appears on the tuber in the form of very slightly depressed and slightly discoloured areas of the skin. Close inspection will reveal the fact that dotted over these areas are numbers of minute black specks, only just visible to the naked eye. When tubers have been lifted and stored for some time the affected areas often become rather more conspicuous and frequently take on a whitish or silvery appearance which is particularly well marked if the tubers have been exposed to light after lifting and thus allowed to become green. In what may be termed severe cases the skin of affected areas may become somewhat dry and hard and the outer layers of it may even begin to flake off. Cracks or wrinkles in the skin may also sometimes occur, and very badly affected tubers may even become somewhat prematurely shrivelled owing to loss of water.

In red and in purple-skinned varieties the colour may be almost completely destroyed. The disease is not capable of producing a rot in potato tubers. It has been suspected of "blinding" the eyes, but this has never been proved and awaits further research.

EFFECTS ON DIFFERENT VARIETIES.—This disease will, apparently, affect all varieties, but it is most evident on a coloured variety such as Arran Victory.

SOURCE OF NEW INFECTION EACH SEASON.—It would appear that the tubers become infected from the soil while they are still attached to the parent plant.

CONTROL MEASURES.—No method of control has been sought, nor has the injury caused, up to the present, been sufficiently severe to warrant control measures.

WATERY WOUND ROT.

This disease has not been considered as of any economic importance in Ireland, but it may cause more damage than has been suspected. As it caused considerable loss in the Eastern Counties of England in 1929 the disease was investigated by Pethybridge and Smith and a report[1] was published from which the following notes are taken:

[1]Pethybridge, G. H., Ph.D., and Smith, Alex., Ph.D. A Watery Wound Rot of the Potato Tuber. Jour. Ministry of Agriculture, London. Vol. 37, No. 4, July, 1930.

CAUSE OF THE DISEASE.—The disease is due to a fungus belonging to the genus *Pythium*, one member of which has long been known as the cause of "Damping-off" of seedlings grown under unsuitable conditions of temperature and moisture. Sadebeck encountered this fungus on potatoes in a field near Coblentz in 1875, and de Bary in 1881 recorded that a potato tuber inoculated by him with Pythium became wholly decayed in a few days in warm weather. Little notice was given to this trouble until it was found in 1916 to be of considerable importance in potatoes in California. There the name "Leak" is given to this disease.

TIME OF OCCURRENCE.—It is not found in the tubers while they are still attached to the plant, although it became apparent not long after lifting. In this respect it differs from Pink Rot, Blight and Black Leg. The losses in 1929 were more serious in crops lifted somewhat early, i.e., in September and the first half of October, and occurred largely but not entirely in ware tubers destined for export. In spite of inspection and elimination of visibly diseased tubers on the farms, some consignments reached the port of lading in an unsatisfactory condition. It may be pointed out here that early lifting often connotes imperfectly set skins and considerable risk of abrasion and wounding, especially in crops dug with the "spinner." It is also to be noted that the weather, at the time of lifting and transport, was still warm and summer-like, and therefore not the best for long distance carriage of potatoes.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—The disease was prevalent on the land of certain farmers who did not make a practice of gathering up and destroying all diseased tubers after lifting time, whereas their neighbours who took the trouble to do this as a matter of routine did not suffer.

APPEARANCE ON TUBER.—(1) The disease seems to start invariably from a wound or an abrasion of the skin of the tuber caused during lifting. (2) It does not start, as Pink Rot and Black Leg rot practically always do, from the actual heel or stem end of the tuber. (3) The skin over the diseased parts is dark and moist, while a dark, sometimes almost black, boundary line is often seen between the healthy and diseased regions—see Figure 56. (4) If, as frequently happens on handling, the skin becomes split, a considerable quantity of a thin watery liquid exudes and this is a striking feature of this type of rot. Thus there arises the condition illustrated in Figure 57, where the diseased tissue appears to have "melted" away, leaving the thin papery skin of the tuber behind. (5) Another characteristic feature of the rot is the rapidity with which it progresses. Under favourable conditions a good-sized tuber may become completely rotten within a day or two. (6) The colour of the decayed tissue exposed when an affected tuber is cut open varies according to whether air has previously had access to the tissue or not. If this has not happened the rotten tissue is but slightly,

if at all, discoloured and a distinct line of demarcation between it and the still healthy tissue may not, at first, be discernible. On exposure to air, however, the rotten tissue turns greyish, then brown and finally almost black, sometimes with a slight pinkish tinge in it. The rotten tissue is quite pulpy.

EFFECTS ON DIFFERENT VARIETIES.—In 1929 the varieties chiefly affected were King Edward, Majestic and Eclipse, but other varieties, such as Boston Kidney and Epicure, were also involved. It is likely that all varieties would be affected if grown exposed to infection and undue warmth.

SOURCE OF NEW INFECTION EACH SEASON.—This is another of the diseases from which the infection comes from the soil.

CONTROL MEASURES.—(1) The return of the rotten tubers to the soil is a sure way of maintaining and even increasing the disease. (2) Growing potatoes too frequently in the same field or, in other words, not following a suitable rotation is another sure means of encouraging the disease. (3) The most obvious means of preventing the rot is to avoid, as far as possible, mechanical injury to the tubers during lifting and handling. This is of particular importance if potatoes are lifted before they are fully mature, and if warm weather conditions prevail at the time.

GANGRENE.

An article appeared in the Scottish Journal of Agriculture, July, 1936, entitled "A Fungus Disease of Stored Potatoes," by N. L. Alcock and C. E. Foister, that must be mentioned. A paper was read on the same disease by the same authorities and J. W. Tervet before the British Association, September, 1936. From this article and paper the following notes are abstracted.

In February, 1936, R. J. Scott, Inspector at the Plant Registration Station, observed a rot in certain potato stocks which he suspected was different from Dry Rot caused by *Fusarium caeruleum*. He saw in this condition the possible clue to a great deal of unexplained rot of stored potatoes in the last few years, and it was arranged that the Department's Plant Pathological Section should carry out an investigation into this disease. The work is not yet completed. The common name Gangrene applied to this disease may seem undesirable, but has been rather widely used, is descriptive, and is not attached to any other disease.

Cause of the Disease. The disease is caused by a fungus which belongs to the genus *Phoma*, but the species has not yet been named.

Time of Occurrence. The stock in which the disease was discovered showed the first signs in January and it continued to

Fig. 56.—Watery Wound Rot. Tuber affected by Watery Wound Rot. (See p.81.)

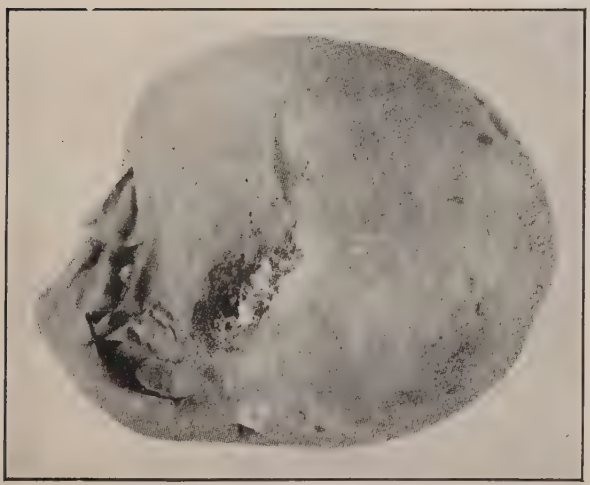

Fig. 57.—Watery Wound Rot. Tuber from which watery liquid has escaped, loose skin being left. (See p. 81.)

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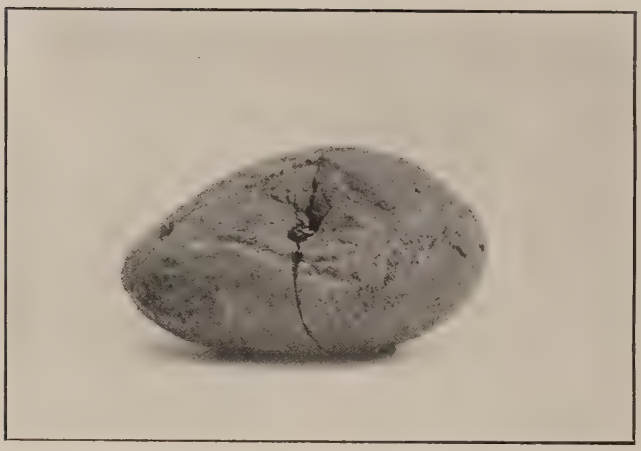

Fig. 58.—Gangrene. Large "Thumb Mark" on a naturally infected seedling tuber. (This had been cut prior to the photograph.) *(Figs. 58, 59 and 60 are reproduced by permission of the Controller of H.M. Stationery Office, London, from the Scottish Journal of Agriculture, July, 1936, Vol. 19, No. 3.)* (See p. 83.)

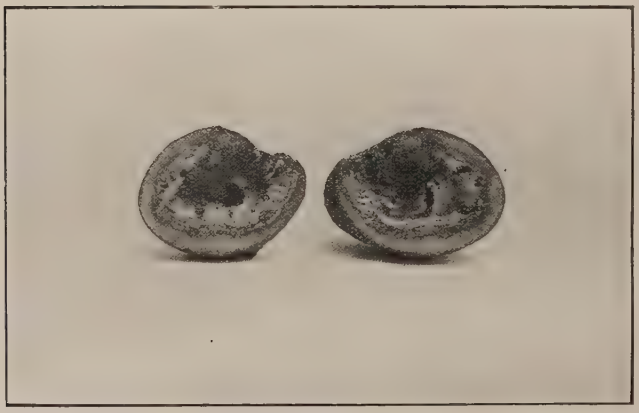

Fig. 59.—Gangrene. Tuber shown in Fig. 58 cut to show internal symptoms. (See p. 84.)

appear in fresh tubers of various varieties week by week up to May. The disease has since been recognised as early as October.

Where Disease is Most Likely to Occur. This disease apparently does not occur to a great extent in pitted crops, only one-ninth of all stocks examined and found to be infected coming from pits, the other eight-ninths coming from boxes. This is similar to the experience with " Dry Rot " caused by *Fusarium caeruleum*. The question of its first occurrence cannot be answered. It is significant that various stocks of Doon Star, on examination this year, were found to be infected, and enquiry disclosed the fact that Doon Star had suffered from a rot very similar to and possibly identical with the present disease as far back as 1927. (This variety was similarly affected at that time in Ireland.)

Doon Star is a comparatively new variety, and as a number of the older varieties such as King Edward, Majestic, etc., have also been found to be infected, it is highly probable that the disease has been in existence for very many years. There is no doubt that it has been taken for the genuine " Dry Rot." It cannot be emphasised too strongly that this is not a new disease, but that it has only now been recognised to be caused by a fungus different from *Fusarium caeruleum*, but with symptoms somewhat like those of the latter that the two have been confused.

Appearance on Tuber. There is one very distinctive difference between rots caused by this disease and those caused by *Fusarium caeruleum*. This disease does not produce any external white pustules with blue bases similar to these produced by *Fusarium caeruleum*. Compare Figure 60 and Figure 51. Under very damp conditions, however, a mass of white to grey-white mycelium of the causal fungus may be produced externally over the surface of the depression but this does not resemble the external fructifications of *Fusarium caeruleum*.

The symptoms of this disease vary considerably according to variety, age of tuber and age of infection. In most susceptible varieties the first sign of disease is a minute circular depression, about 1/16 inch in diameter, and quite shallow. The number of these depressions on a single tuber may vary from one to many; in the latter case they are usually congregated together. As the disease progresses the depressions enlarge more and more, until diameters of as much as one and two inches are reached.

The larger depressions, which can be likened to " thumb marks " (see Figure 58), also resemble, unfortunately, the early stages of " Dry Rot." In some varieties the disease may progress internally to a considerable extent before external signs of a depression or irregular collapse occur.

Quite commonly, one moderate-sized depression may be on one side and one or more minute depressions on the other side

of the tuber. In this case on cutting, it is found that a large internal rot has progressed to the opposite side, and where the advancing rot touches the skin, there the small depressions occur. (See Figure 59).

In the advanced stages, infected tubers may become wrinkled and have a superficial resemblance to "Dry Rot." This wrinkling, however, is rarely so typical as that of the Fusarium disease, but is usually more dispersed. The ridges of skin do not, as a rule, surround the depression or infected area in rings, as is so typical of infection by Fusarium, but somewhat resemble an irregular network over the whole depression.

Effects on different varieties. The following is a list of varieties in which the disease has been found naturally :—

First Earlies.	Epicure	Arran Consul.
Arran Crest	May Queen	Doon Star
Arran Pilot	Sharpe's Express	Gladstone
Arran Scout	Witchhill	Great Scot
Ballydoon	*Second Early.*	King Edward
Di Vernon	Arran Signet	Majestic
Doon Early	Catriona	*Late Maincrop.*
Duke of York	*Early Maincrop.*	Arran Cairn
Eclipse	Arran Banner.	Kerr's Pink

From the experience of only six months, it would be premature to attempt to classify these varieties according to their degree of susceptibility and the extent to which the disease progresses. For example, Duke of York, when infected, takes the disease very severely and the whole tuber may be rotted quite early; but, so far, very little of this variety has been found infected. But where the disease has been found in Doon Star, Doon Early and Catriona, it has been very severe, a very high percentage being badly affected. A moderate percentage of infection has been found in May Queen, Epicure, Arran Pilot, King Edward and Kerr's Pink.

Source of new infection each season. It has already been proved that the fungus can live in the soil. Whether infection can take place from boxes which had previously held diseased tubers is not known. It is of special interest to note that Abundance, Doon Star and a seedling tuber when bruised and placed in contact with a portion of a diseased potato contracted the disease also. This confirms the opinion that the disease actually spreads in storage from a source of the disease such as a single diseased tuber.

Control Measures. As yet nothing is known of any possibility of controlling the disease in storage. It is, however, a wise procedure to keep the sprouting seed in a well-lighted cool house, examine the boxes regularly, remove and burn all diseased tubers.

SPRAING AND INTERNAL RUST SPOT.

This disease was very prevalent in parts of Great Britain in 1893, so prevalent that some growers became alarmed and thought that another new disease on a par with Blight had appeared. The Board of Agriculture even took the trouble to get a special report prepared by Archibald Findlay, famous as the raiser of Up-to-Date, British Queen, Majestic and many other varieties.

Findlay apparently knew as much about the disease as is known at the present day. In his book[1] he writes :—

" Owing to extreme climatic conditions, spraing was a very common fault in the crop of 1893—so common, in fact, on lands where formerly, if it ever appeared at all, only in such a trifling way as not to arrest attention; but this season it was so common on all lands of a light nature as to be spoken of as a new disease of a most insidious kind, as there was no indication of anything being wrong until you had cut the tuber. So, having had a fair look round and a careful examination of the crops in my own neighbourhood, I came to the only conclusion possible, that it was only the potato growers' old acquaintance—no doubt very much accentuated by reason of extreme climatic conditions[2] (drought) prevailing during the summer and autumn—in some parts of Scotland called ' sprain,' in other parts of Scotland ' spraing,' which, according to Dr. Jamieson, means a long stripe, including the idea of variegation. ' Sprainging,' according to the same authority, means tints or shades of colour; now, that exactly describes what we have here, for on cutting a potato with this fault, you find it variegated in the sense that it is marked in a lesser or greater degree with stripes and spots of various shades of brown—some of them so faint as scarcely to be visible, and others so dark as almost to be black—which, with the white setting of the unaffected parts, conveys a sense of true variegation. In some parts of England it is spoken of as Canker, but I prefer the Scotch name 'spraing' as best describing this fault in the potato."

Findlay said he never saw " spraing " on clay land, or on loam lying on clay or on sharp clean gravel, but it is almost constant on certain varieties when grown on sandy loam lying on soft pale sand or on sand in which there is ochre.

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[1]Findlay, Archibald. *The Potato: Its History and Culture.* 1905, p. 6.

[2]Symons's *British Rainfall*, 1896, says: " There have not been quite so many ' absolute ' droughts as usual but there have been more partial ones than in any recent year except 1893 and that they have lasted longer than the average but not nearly so long as in 1893."

The writer's attention was first drawn to this disease in 1911 by a County Down farmer, who was able to correctly inform him that the disease occurred only in small sandy patches in one of his fields, that it would appear on British Queen and not on Up-to-Date grown in the same place, and that affected tubers planted on any other part of his farm would produce healthy tubers. There is not much more known about this disease in 1937 than there was in 1893.

Cause of the Disease. Recent work would appear to show that Spraing is not a single disease, but that the term has been used in the past to cover several distinct maladies of the potato tuber. There is, therefore, probably no single cause of Spraing, but perhaps several causes. Bacteria are said to cause one type of Spraing, and for another it has been claimed that a virus is responsible. In certain instances, too, it would appear that the cause may be a deficiency of boron or some other element in the soil. Until the various types of Spraing have been more thoroughly elucidated and carefully studied, the cause or causes must remain doubtful.

Time of Occurrence. The disease may be found in the tubers of British Queen from mid-July onwards.

Where Disease is Most Likely to Occur. It was definitely known, even as long ago as 1893, that this trouble occurs chiefly in sandy or gravelly soils, especially those deficient in organic matter, and more likely to occur in a dry than in a wet season.

Appearance in the Tuber. (1) There may be no external marks on the skin of the tuber to give an indication of the trouble within, although with a certain type in which the stripes in the flesh are curved or arc-like, careful examination may show slight cracks or circular small dark patches on the skin.

(2) When the tuber is cut, rusty brown blotches or stripes are seen in the flesh. (See Figure 61.) In really bad cases almost the whole flesh of the tuber is discoloured, and the tubers are of course unsaleable. These discoloured parts may take the form of spots or blotches distributed quite irregularly over the cut surface of the tuber, or they may be in the form of concentric rings or arcs, the ends of which often reach the skin. Broadly speaking, there are the two forms :—

(a) lesions arc-like; may, perhaps, be considered true Spraing.

(b) lesions spotty or blotchy.

Quanjer says (a) is due to a virus, contracted from the soil and affecting the tubers of the plant only. (b) may be called Internal Rust Spot, and probably there is more than one type. One form of the blotchy type is apparently hereditary and has been given the name "pseudo net-necrosis."

Effects on Different Varieties. There is no doubt but that some varieties are more subject to this trouble than others. The worst affected that the writer has seen are Irish Chieftain,

Fig. 60.—Gangrene. Large external wrinkled depression in another seedling naturally infected resembling Dry Rot. (Compare with Fig. 51.) (See p. 83.)

Fig. 61.—Sections of a potato tuber suffering from Spraing. (See p. 86.)

Golden Wonder and British Queen. Findlay said he never found it in very early varieties, or in the more forward of the second early class of potatoes. " I have attributed their immunity in a great measure to the fact that they finish their growth under better weather conditions than the later varieties. But with the later second earlies and maincrop or late varieties it has always been a common fault in this district, especially in that *firm*, *dry* order of potato . . . Paterson's Victoria . . . Champion . . . . Clark's Maincrop Kidney." It is general experience that dry floury varieties are more liable to be affected than wet " soapy " tubers. In recent years it was found bad in certain districts in Great Britain on Kerr's Pink, Duke of York, Arran Comrade, Arran Chief, Tinwald Perfection, King Edward, Golden Wonder, Bishop and Field Marshall.

Source of New Infection each Season. Until more information has been obtained, it is impossible to say how the disease is carried over from one season to another. In most cases, at all events, it appears to be a soil trouble and not a hereditary disease.

Control Measures. More information is badly required regarding control measures. Green manuring proved highly efficacious in warding off the disease in trials conducted by the Leeds University Department of Agriculture. Findlay, already mentioned, maintained that he grew crops of several varieties free from " Spraing " in three successive years on land that was notorious for producing the trouble by applying best kainit at the rate of 4 cwt. per statute acre early in the spring, and at time of planting 10 cwt. per acre of a compound manure analysing:— 5 per cent. ammonia, 12 per cent. soluble phosphates, 8 per cent. insoluble phosphates and 12 per cent. potash. He was of the opinion that the trouble is due to the want of a complete manure, but this is certainly not generally, if ever, the real cause. Shortage of water has been assigned as a cause, due probably to the disease appearing in dry places and being most plentiful in a dry season.

PIT ROT.

This disease was noticed as long ago as 1909 and since then affected tubers have been submitted to the Department for diagnosis from at least eight counties in Ireland.

CAUSE OF THE DISEASE.—The cause of the disease is unknown, but Pethybridge came to the conclusion that this trouble was probably due to the action of some deleterious gas (or liquid) in the potato pits, and not to an organism.

TIME OF OCCURRENCE.—The disease occurred on potatoes during storage and was mostly found after the potatoes had been in pits for two or three months.

WHERE DISEASE IS MOST LIKELY TO OCCUR.—The disease occurs only on potatoes stored in pits, and never on potatoes stored in sprouting boxes. In the Williamstown district, Co. Galway, the trouble was common in the season 1935-36, but no affected tubers were found in the season 1936-37.

APPEARANCE ON TUBER.—Six affected tubers are shown in Figure 62. Affected tubers show circular dark depressed areas on their surfaces. The roundness of the spots is quite characteristic and they vary in diameter usually from $\frac{1}{8}$th to $\frac{1}{2}$-inch. They are scattered apparently at random over the surface of the tuber. The margins of the diseased areas are usually well defined and smooth, sometimes two adjoining "pits" meet one another and partly coalesce.

When freshly removed from the pit the surfaces of the dark areas on the tubers are sometimes plane and not concave. In such cases the injured tissues are still moist; but on exposure to air the affected portions dry up and the skin sinks in, thus forming the shallow depressions.

In the centre of the depression an eye is sometimes to be found, but much more commonly a lenticel (or breathing pore) occupies this position and a minute hole or opening in the skin is often discernible at this point.

Beneath the pit the tissues of the tuber are dead to a certain depth; and, broadly speaking, the greater the diameter of the pit the deeper the dead tissue descends into the interior of the tuber. The line of demarcation between the diseased and healthy tissues is always well marked and in a vertical section is always an arc of a circle.

EFFECTS ON DIFFERENT VARIETIES.—The disease has been seen on Up-to-Date, Champion, Irish Queen, British Queen.

SOURCE OF NEW INFECTION EACH SEASON.—As the disease is thought not to be due to an organism, there is no new infection each season, and if this surmise is correct the disease can be, at once, avoided by taking proper precautions when pitting the potatoes.

CONTROL MEASURES.—It is now thought that Pit-Rot is probably caused by the action of some deleterious gas (or liquid) in the potato pits, the nature of which is, at present, uncertain. If this be so, attention to the proper construction and ventilation of the pits, as well as more careful attention to excluding diseased tubers from them, is likely to prove a practical and successful means of preventing the trouble.

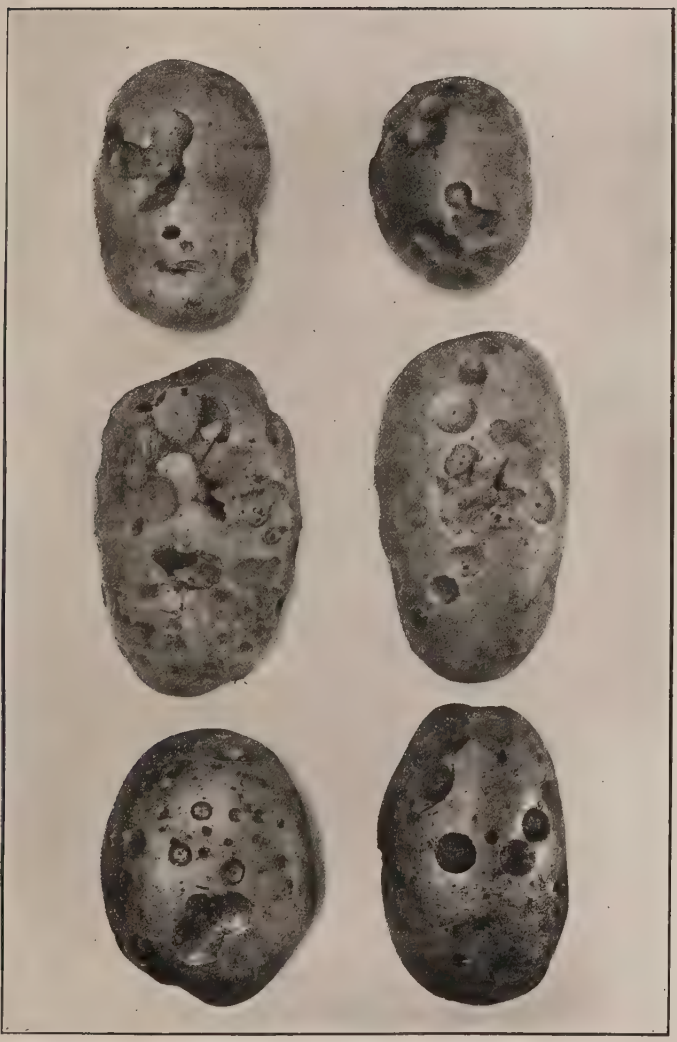

Fig. 62.—"Pit Rot." Potato tubers affected with "Pit Rot." Variety, Up-to-Date. (See p. 88.)

C. INJURIES DUE TO WEATHER AND SOIL CONDITIONS.

FROST INJURY.

As most growers know only too well, frost can and often does completely blacken and kill the foliage. The minor injuries caused by frost are not so well known. A rather severe frost on 4th June, 1936, affected the foliage in most parts of the country. Bog lands, all low damp lands and drills freshly scuffled suffered most injury. In many fields the tops were completely killed, while in other fields 8 to 12 days after the frost the foliage looked as if it were severely affected by Crinkle. This effect was very noticeable on Kerr's Pink and Up-to-Date. There is, however, no reason to be in any doubt as to the cause of the trouble, as on examination of the leaflets portions are " burned off " completely, as if they were bitten off. The margins and tips of the leaflets turn yellow. Since the inner parts of the leaflets are often not injured, they continue their growth, the margins appear to be too short, hence the middle portions become wrinkled. Another peculiar feature of the foliage that is often observed where frost occurs during the early stages of growth is that the young leaflets may be so severely affected that their growth is stopped, the petiole (midrib) of the leaf grows to the normal length, but instead of its having the usual number of leaflets, only a number of small button-like structures develop along the midrib. Some varieties recover better than others; Arran Pilot, not an exceptionally vigorous grower, usually makes a surprisingly good recovery.

HAIL INJURY.

Hail can cause very serious injury, and leave the foliage in a very ragged condition. Holes of various shapes are torn in the leaflets; in some cases the piece is punched clean out. In the majority of cases, however, the hail tears the leaves usually between the veins.

The largest and the terminal leaflets suffer most; those nearer the stem may escape completely. British Queen suffers severely, but Eclipse is much more difficult to injure.

" YELLOWING " OF THE FOLIAGE.

What was known as " Yellow Blight " was at one time a serious trouble in parts of the West of Ireland. About the middle of July the potato plants commence on a large scale to turn yellow in colour, this being followed after no long interval

by the gradual death of the plants, the crop being, of course, a seriously diminished one, or in some cases practically nil. Pethybridge investigated this trouble in 1909, and prior to that time " yellowing " had been attributed to more than one fungus and to various bacteria. It was found that " yellowing " is a seasonal phenomenon, that is to say, it is much more prevalent in a given district in certain seasons than in others. Again, it is intimately connected with the nature of the soil, and with manuring and cultivation. On reasonably good soils, adequately manured, properly cultivated, "yellowing " is as good as unknown.

There are two principal extremes of soil on which " yellowing " is common, namely, in undrained wet land, especially of a peaty nature, and on light, shallow dry soils especially on hill slopes or in cut-away bogs where only a scanty covering of soil clothes the surface of the solid rock. As might be expected, " yellowing " is general on the former class of soil in a wet season, and on the latter soil in a dry season.

No fungus or other parasite could be found as a cause of the disease. Drainage and liberal manuring were found to prevent " yellowing " except in rare cases in very shallow soils where apparently the absence of soil into which the roots could penetrate in search of more food materials was at the bottom of the trouble.

RUST.

This is a seasonal trouble, much in evidence in some districts in occasional seasons, and rarely seen in other years. The leaflets or portions of them crumple up and die, becoming a rusty brown colour, hence the name. The trouble usually appears when the season is fairly well advanced. No parasite of any kind has been discovered as the likely cause of the trouble. The yield may be pretty seriously diminished. In 1926 the writer saw a series of manurial trial plots at Craibstone, the experimental farm of the North of Scotland College of Agriculture. Three of these plots had received no potash, and the foliage on these plots was badly " rusted " when the foliage on the other plots was quite green and healthy. Since then, whenever the writer had an opportunity of making inquiries regarding any crop that had its foliage badly " rusted," he has always found that no potash manure had been applied.

The trouble is certainly partly due to shortage of potash, but at times it may be due to water shortage. It is not propagated by the seed tuber.

D. INJURIES DUE TO EELWORM, INSECTS, SLUGS, ETC.

EELWORM.

There are two quite distinct types of Eelworm that injure the potato crop and they are known respectively as the Root Eelworm (*Heterodera schachtii*) and the Stem Eelworm (*Anguillulina dipsaci*).

The former, as its name indicates, attacks the roots, and the females produce on them large numbers of small cysts (filled with eggs) just visible to the naked eye. The latter attacks the tubers, causing them to rot rapidly.

The Root Eelworm has been the more troublesome and is generally regarded as one of the worst pests that has ever attacked the potato crop. It is sufficient to say that in a case recorded by Leiper[1] and Triffitt, where 7 cwt. of seed was planted in a badly infected field, the yield was $5\frac{1}{2}$ cwt. only.

These writers also mentioned other facts which should act as a very serious warning to all potato growers in Ireland, where so many potatoes are frequently grown on the same land by small farmers. "The sugar beet industry, begun in Germany about 1800, was for many years so successful, and beet growing proved so profitable, that sugar beet was grown repeatedly on the same land. As a result of this, eelworm became very prevalent, and in 1876 no less than 24 factories were closed down and thousands of acres of previously fertile land had to be returned to pasture. Scientific investigation of the eelworm problem was begun in Germany as early as 1870, and is still being carried out, but so far no practical measure of ridding infested land of eelworm, other than by prolonged rotation with non-susceptible crops has been devised. That the pest can be controlled by this means is amply demonstrated by the present day success of beet-growing in Germany." Another proof of the success of this method of control is recorded in the 17th Report of the National Institute of Agricultural Botany, 1935-36. "In 1936 the (potato) trials (at Ormskirk) were carried out on one of the original immunity trial fields which had not been planted with potatoes since 1928, when the trials were a complete failure owing to the presence of potato eelworm (*Heterodera schachtii*). Potatoes were again grown on this field on the advice of Dr. H. W. Miles, of Manchester University, who has made cyst counts every year since 1928, and who reported that the viable cyst content was so reduced by 1935 that the field was again safe for planting. The growth of the trials was uniform and vigorous, no symptoms of potato sickness occurred, and only occasional cysts were found on the roots of plants lifted during the growing season. The value of a long rotation in combating

[1]Leiper, R. T., M.D., D.Sc., F.R.S., and Triffitt, M. J., D.Sc. The Eelworm Problem. Rothamsted Conferences XVI., Feb. 20, 1934.

the eelworm menace to the potato crop is apparent." The writer saw these crops in 1928 and again in 1936, and the difference was most striking; the 1928 crops were a hopeless failure, whereas the 1936 crops were well above the average of the country. According to Dr. Leiper and Dr. Triffitt, the present position with regard to the control of the Root Eelworm trouble in potatoes is that, pending the discovery of some method whereby the eelworm can be eliminated from infected land, the only measure that can be adopted by growers to avoid financial loss upon the actual crops and grave damage to the land is the consistent use of a four, or preferably six-course rotation. They further state : " With regard to the spread of eelworm throughout the country, investigations have shown that the most fertile source of distribution to new districts has been by the use of seed potatoes grown in infested land. Cysts have been found in the fragments of loose soil in potato bags and adhering to the tubers, in sufficient quantities to produce an appreciable infection in previously clean land within a single season. An average of seven cysts per tuber has been found in such a sample of seed, and as each cyst may contain several hundred eggs, the rapidity with which the eelworm has spread is amply accounted for."

What has happened in other countries should be a warning to potato growers in Ireland.

No grower who sets any value on his potato crop should bring new seed on to his land without taking all possible precautions to ensure that such seed was grown on clean sound land. Any person carefully perusing this section cannot fail to be impressed with the number of diseases and pests that may be introduced by affected seed to land previously free. Many such diseases and pests are extremely difficult to eradicate.

The position with regard to the Root Eelworm in the Irish Free State has been pretty fully investigated by Carroll[1], and probably most of the danger spots are confined to sandy patches around the coast, where seed potatoes are never grown. The districts chiefly concerned are Rush, Co. Dublin; Arran Islands, Omey Island, and the Magharees, Co. Kerry.

The trouble was first noticed by growers at Rush about 1918 and was called by them " potato flu," as the severe epidemic of influenza harassed the country at that time. In England the trouble is usually locally known as " potato sickness " or " potato dab."

Description of affected plants.—The following description of affected plants is given by Carroll[1]:—

" Under field conditions the plants may appear to grow normally for a short time after they appear above ground, but before they reach any considerable size they begin to show signs of ill-health. They fail to grow as rapidly as they should, and

[1]Carroll, J., M.Sc., D.I.C. A Study of the Potato Eelworm (Heterodera schactii) in the Irish Free State. Jour. Dept. of Agr., Vol. XXXII., No. 2.

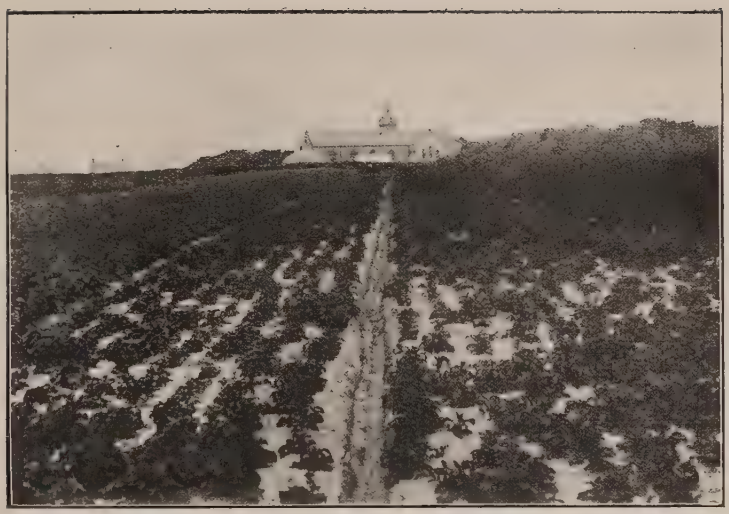

Fig. 63.—Eelworm. Plants grown on plot infested with Eelworm. *(Reproduced from Journal, Department of Agriculture, Vol. 33, No. 2.)* *(See p. 93.)*

Fig. 64.—Eelworm. Plot of healthy plants grown near to plants shown in Fig. 63. (See p. 93.)

Fig. 65.—Eelworm. Plant grown in infested soil, natural condition. (See p. 93)

Fig. 66.—Eelworm. Plant grown in infested soil sterilised before the set was planted. (See p. 93.)

are soon noticeable by being much smaller and less robust than normal healthy plants growing in close proximity. Plants showing severe symptoms remain in a dwarfed condition, often not reaching a height of more than three or four inches. Compare Figures 65 and 66. The stalks of such plants remain thin and spindly throughout their period of growth. The leaves are **generally undersized.** They may exhibit abnormalities of shape and texture, and are not as bright and sappy looking as they should be.

The lower leaves particularly are flaccid and velvety to the touch, and have a pronounced tendency to wilt and drop off prematurely.

The whole plant generally yellows very early in the season and dies off shortly afterwards."

The contrast between a patch of diseased plants and an adjoining patch of healthy plants is strikingly illustrated by Figures 63 and 64. A potato plant showing such obvious disease symptoms as described can be pulled out of the ground with great ease, the reason being that the roots come away very easily from the plant, and remain behind in the soil. If such a badly diseased plant is dug up and the soil shaken away gently, it will be seen that the root system is very poor. **Attached to the roots will be seen numbers of tiny spherical yellow or brown ball-like bodies** (about the size of a pin-head). These are called eelworm cysts. Each cyst is the dead distended body of a female eelworm packed with eggs. The cyst has a short, narrow tube-like interior portion or neck which remains inserted in the substance of the root. This portion was the head end of the eelworm, and the spherical part of the cyst comprised the remainder of the eelworm body. The number of eggs in a normal cyst may vary from a few score up to a few hundred, depending upon the size of the cyst. When cysts first appear on the roots they are white in colour. Later they become pale yellow, and continue to become gradually darker until they are a deep mahogany brown." The eggs remain in the soil during the winter. They will not hatch out until about April. It is a very remarkable and well authenticated fact that even at the end of the dormancy period the eggs will not hatch, or at least the percentage hatch will be very small, unless stimulated to do so by the presence of the secretion from the roots of growing potatoes.

The pest usually appears in patches in the field. In these patches the plants are "miserable," while a yard or two away good vigorous plants will be growing. The trouble has generally been much more prevalent in open sandy soils, but this may be partly due to the fact that it is usually in such soils potatoes are too frequently grown.

It is remarkable how frequently plants affected with eelworm are also affected by the fungus *Corticium solani*.

At Rush, Eelworm is known to attack both early and late varieties of potatoes.

The earlies are lifted from the last week of May onwards. They have made considerable growth before the hatching of

Eelworm eggs has become general, and consequently the effects of Eelworm are not usually very obvious on the early varieties. From about the beginning of June onwards the trouble makes itself felt on patches of second early and maincrop varieties.

The Root Eelworm attacks the roots of the plant, but not the tubers. The tubers are, of course, often greatly reduced in size owing to the roots being unable to perform their normal functions.

THE STEM EELWORM, a form or race of the common eelworm so well known in connection with injury to clover, oats, bulbs, etc., also attacks the potato, though no case of attack has yet been recorded in Ireland. The Stem Eelworm was first described by Kühn in Germany in 1888. A much fuller account of it was given four years later by Ritzema Bos. He suggests that the disease is introduced by infected seed potatoes and notes that the outbreak of the disease in Holland coincided with that in Germany in 1888.

The disease was not recorded in England until 1922, though prior to that date the injury caused by this eelworm was probably attributed to Blight. There is a remarkably close superficial resemblance between the injury caused to the tuber by Eelworm and that due to Blight. Even Ritzema Bos in 1892 notes that the disease has probably been confused with Blight. This, of course, refers to its effects on the tuber, not on the foliage.

Dr. Goodey[1] records that the disease is not of recent occurrence in this country (England), as a grower informed him that he had seen it on and off for the past 12 years, not only in the Eastern Counties, but also in Scotland. He had been aware of the fact that it is different from Blight, in spite of the fact that diseased tubers examined by certain experts had been proclaimed by them to be suffering from Blight; evidently the superficial resemblance between the two diseases had been responsible for the error of judgment. It is to be hoped that the disease is not lurking in this country **and Blight getting even more blame** than it deserves. If any grower notices a disease on his potatoes that resembles Blight, but about which he has some doubt, especially in a season when there is not much Blight on the foliage, he should at once send specimens addressed to the Secretary, Department of Agriculture, Dublin, and marked Potato Section. Dr. Goodey found no well-marked symptoms of disease on the stems and leaves, and for this reason the early detection of the disease is practically an impossibility. Ritzema Bos said he found that the stems were thickened and brittle and that the leaves were curled and wrinkled. As nothing was known of virus diseases at that time, his plants may have been badly affected with Crinkle as well as with the Eelworm. Dr. Goodey, at all events, carefully examined the stems and foliage of plants, the tubers of which were badly affected, and failed to find any symptoms of disease which would even arouse suspicion.

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[1]Goodey, T., D.Sc. Eelworm Disease of Potatoes, caused by Tylenchus (now known as Anguillulina) dispsaci. Jour. Helm., Vol I., p. 199, 1923.

On the tuber external symptoms very similar to those of Blight will be found. The surface is discoloured in patches, but more frequently there is a breaking down of the skin with an obvious destruction of the underlying tissues. When cut across, the diseased areas are found to extend for a short distance into the substance of the tuber as a brownish discolouration, the newly attacked areas being paler in colour than the older ones. The rot goes deeper and deeper until in a short time all that remains of the tuber is the skin.

Dr. Goodey[1] says : " It is not a difficult matter, after a little practice, to recognise the external characteristics of those tubers definitely attacked by the parasite. **There is frequently a characteristic cracking of the skin over the diseased discoloured area.** In the case of lightly affected tubers the skin may not have become shrunken and cracked and only a slight discolouration or mottling of the skin in a few spots may be noticed." Such lightly affected tubers are easily passed over and are difficult to recognise without careful scrutiny."

It is quite probable that the disease is spread from place to place by means of such lightly affected tubers getting into stocks of seed potatoes. When a cut is made under the skin of a well-diseased tuber the tissues most frequently show a light brownish-white appearance and are mealy and soft to the touch. As already indicated, all doubtful tubers should be submitted to the Department, when a microscopical examination will show whether the trouble is due to Eelworm or Blight.

The Stem Eelworm is shaped like a worm, but is too small to be seen by the naked eye. If it were visible no confusion would ever have arisen between the damage it causes and the injury due to Blight.

All varieties of potatoes are attacked by this parasite. If anything, King Edward seems to be slightly less susceptible than the majority of commercial varieties.

Control Measures.—(1) If the land is free from these two Eelworms every possible precaution should be taken not to purchase seed potatoes grown on land infected with them. Furthermore, no cabbage plants, turnips or roots of any kind with soil adhering to them should be brought from infected land to clean land.

Where the land is already infected the following measures should be adopted :—

(1) A good rotation should be followed, so that as long a period as possible should elapse between successive potato crops. Four years is the shortest period of practical value, but a six year's interval is recommended.

(2) Infected soil should not be moved to a clean portion of the farm, either by implements, roots of plants, worker's boots, horses' feet, etc.

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[1]Goodey, T., D.Sc. The Stem Eelworm. Jour. Helminthology, Vol. VII., No. 4, Dec., 1929.

(3) Infected seed has repeatedly been responsible for the transference of the Stem Eelworm, and the Root Eelworm has been found in quantity in the soil adhering to seed tubers.

(4) When potatoes are dug all the tubers should be most carefully cleared out of the land, so as to prevent "groundkeepers" appearing in the following crop, thus providing the means of support for the Eelworms, and so helping to carry on the trouble.

(5) All infected potatoes retained on the farm should be carefully boiled.

(6) The soil from potato sacks, the sweepings of the potato house, etc., should never go into the manure heap.

COLORADO POTATO BEETLE.

Few insects have attracted the same amount of attention as the Colorado Potato Beetle, or "bug" as it is misleadingly termed in America. Irish potato growers may fervently hope that the beetle will never be anything more than a name to them. It can, however, be definitely stated that the utmost watchfulness will be necessary to keep the insect from gaining a foothold in this country. Should it succeed in doing so, the expense and labour involved in controlling its ravages would be enormous. The beetle both in its larval and in its mature state devours the potato foliage until there is none left, and the plants look like mere skeletons of themselves.

While this insect was confined to North America, Irish potato growers had little interest in its movements. Indeed, many entomologists believed that the insect would not survive under European climatic conditions, but that idea has been proved to be far from correct, as during the past fifteen years the insect has shown itself as much at home in Europe as in its native country.

The true potato beetle, *Leptinotarsa decemlineata*, Say, was discovered in the region since known as the Territory of Colorado, in 1824, by the entomologist Thomas Say and was found by him feeding on a wild species of *Solanum* (*S. rostratum*) peculiar to the Rocky Mountains. For years after its discovery it lived, as before, a harmless life and was by no means a common insect. It was only when the cultivation of the potato reached the base of the Rocky Mountains with the advance of colonisation westward, that the beetle displayed a taste for the potato and soon forsook the native Solanums on which they had been feeding.

> "It was first noticed in potato fields in 1859 about 100 miles west of Omaha in Nebraska, and was at that time spreading rapidly eastward. In 1861 it invaded Iowa, and in 1864 and 1865 it crossed the Mississipi into Illinois. In 1866 it overran the Southern parts of Wisconsin, in 1867 it passed into Indiana, in 1870 it crossed the broad St. Clair River and entered Canada. By 1873 the onward-spreading pest had reached Quebec and all the States bordering on the Atlantic."[1]

[1]Bates, Henry Walter. The Colorado Potato-Beetle. Jour. Royal Agr. Soc., Eng., Vol. XI., Pt. 2, Second Series, 1875.

Fig. 67.—Colorado Beetle. Attacked potato haulm, showing two egg clusters, grubs and adult beetle; and (left) grub, pupa and adult beetle (all natural size). (See p. 97.)

(Reproduced from Advisory Leaflet No. 71 of Ministry of Agriculture and Fisheries, London, by permission of the Controller of H.M. Stationery Office, London.)

The Colorado Beetle appeared in England at Tilbury in 1901 and again in 1933 and was with great difficulty exterminated.

The beetle succeeded in establishing itself in France about 1920 and was probably introduced along with war material from America. Efforts were made for some years to control it, but the beetle continued to spread and by 1935 had traversed most of the north of France and crossed into Belgium. In 1936 it established itself in Luxembourg and invaded portions of Germany for the seventh time. It was successfully combated on all previous occasions, but present prospects of extermination in that country are not very hopeful. It has also reached the Dutch frontier, and it is difficult to see how it can be stopped from overrunning that country seeing that it has become very plentiful in adjoining territory. The only hope for Irish growers is to make sure that the beetle does not get a hold in the country. Fortunately the beetle is comparatively large and can easily be recognised from the coloured illustration, see Figure 67 and from the following description.

Description.—The beetle is a conspicuously coloured insect about three-eighths of an inch in length, of plump oval form and of a creamy-yellow colour, with *ten* black stripes along its back, or rather its wing-cases, which when closed, as they are in repose, cover the greater part of its upper surface. The stout legs, with their broadish feet, well adapted for clinging to the surface and edges of leaves, are almost wholly of a reddish colour, and the forepart of the body is yellow, with black markings. It has a pair of well-developed membranous wings, folded under the closed wing-cases, which it uses only in the warm days of summer, and, as it appears, only when requiring to migrate from one field or district to another. But it flies slowly and heavily, the rosy colour of its wings contrasted with the gaily-striped wing-cases rendering it in its flight a very conspicuous object. There is no native beetle or other insect in the least resembling it, unless the useful lady-bird on account of its rather bright colouring might be mistaken for the beetle. The lady-bird apart from being smaller has not the ten conspicuous lines along its back, and in most respects is quite distinct.

One female beetle may lay from 500 to 1,000 eggs. The eggs are of a bright yellow colour, about one-thirty-second of an inch in length. They are deposited in clusters on the under side of the leaves, and hatch out in about a week. The larvae grow rapidly and when nearing full size consume a large amount of foliage. The full grown larva is a stout fleshy grub with a black head, having six horny legs attached to the anterior part of the body, and a very convex and corpulent abdomen; the larva is yellow in colour and has a double row of very distinct black spots along each side. The larva after about seventeen days passes into the " pupa " or dormant state in the soil and escapes from the pupa skin as a beetle at the end of a further ten days. Two or three generations are produced in a season, so that one pair of beetles could at the end of one season be responsible for a family of anything up to 250,000,000 beetles. This figure,

exaggerated perhaps as it makes no allowance for accidents, shows, however, the extreme necessity for dealing with any beetles that may reach this country before they get time to multiply.

Towards the end of summer, the last generation of the insect has been completed; there remain no eggs or larvae on the plants, and the perfect beetles which survive burrow their way beneath the soil to a depth of 18 to 20 inches, and remain quiescent until the spring of the following year.

Control Measures.—If any potato grower sees an insect, especially an insect bearing a resemblance to the Colorado beetle feeding on the foliage of his potato crop, he should immediately forward a specimen in a box for identification to the Secretary, Department of Agriculture, Dublin, and proceed to collect and burn as many of the insects as can be seen on the foliage. The Department will take immediate steps to deal with the case. Time is all important, as a few extra days delay might make it an impossible task to get the beetle exterminated.

THE POTATO TUBER MOTH.

The Potato Tuber Moth, *Phthorimaea operculella* greatly enlarged is shown in Figures 68 and 69. The larva or caterpillar of this moth proved very damaging to potatoes in Tasmania as long ago as 1854. It was first observed in the U.S.A. in 1856 at San Francisco. According to Graf, an American worker, its distribution in the U.S.A. and foreign countries was as follows in 1917 : California, Texas, Florida, North and South Carolina, Virginia. The foreign countries are Tasmania, New Zealand, Australia, Alegria, South Africa, India, Southern Europe, Italy, France, Spain, Canary Islands, Azores and Hawaii. It is regarded as the worst potato pest in California. The injury it can cause to the tuber is shown in Figure 70. A number of heavily infested consignments of potatoes reached Great Britain in 1933 and 1934 from the Valencia district of Spain, and indeed it is no uncommon occurrence for consignments of potatoes to be refused admission for this reason. The moth or its caterpillar has been found from time to time in consignments from Spain, The Canaries, South Africa, Malta, Cyprus, Portugal and Egypt. There is no guarantee whatever that the moth could not survive in this country.

Description.—The moth is small, grey and when fully stretched its wing spread is about half an inch. It flies by night, hiding under clods or such cover during the day. According to Stuart,[1] the adult moth is short-lived, the male living 1 to 14 days and the female 2 to 22 days.

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[1]Stuart, Wm. The Potato. 3rd Ed., 1928, pp. 304-8.

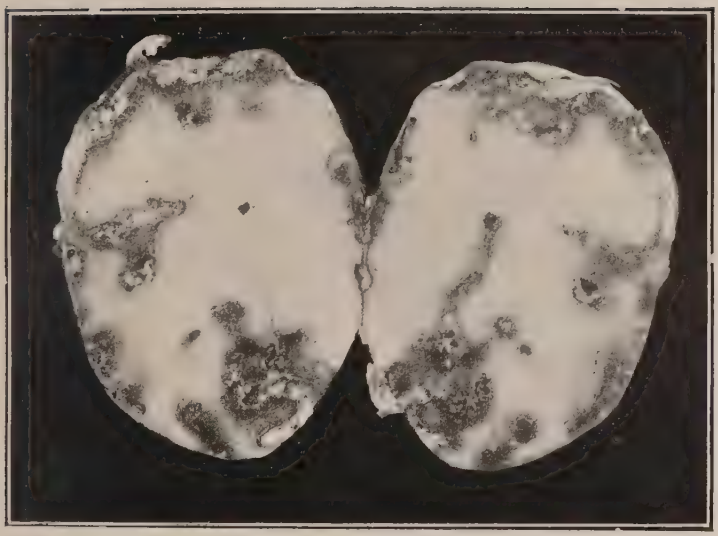

Fig. 70.—Potato section showing injury by larvae of the Potato Tuber Moth. (From the *Potato Tuber Moth*, by J. E. Graf, U.S.A. (See p. 98.)

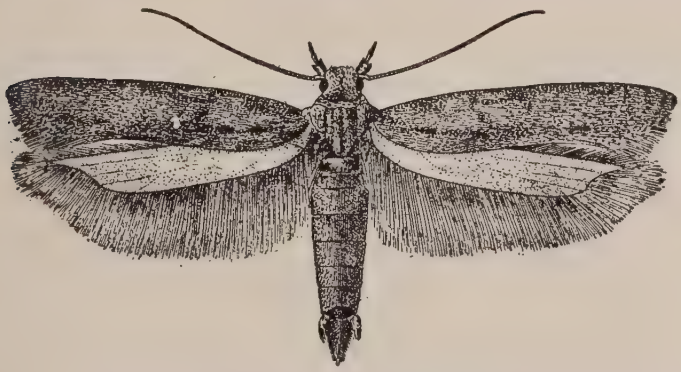

Fig. 68.—The Potato Tuber Moth (*Phthorimaea operculella*) **greatly enlarged.** From the *Potato Tuber Moth*, by J. E. Graf, U.S.A. (See p. 98.)

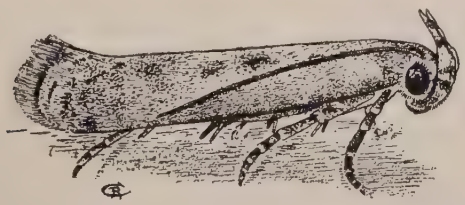

Fig. 69.—The Potato Tuber Moth. Natural position at rest. Much enlarged. From the *Potato Tuber Moth*, by J. E. Graf, U.S.A. (See p. 98.)

The female lays her eggs on the under side of the potato leaf. When potato tubers are accessible the eggs are deposited on the tuber, but generally speaking the green leaf is preferred by the insect. The period of incubation varies from 5 to 34 days depending on season and temperature. The newly hatched caterpillars seldom move about but commence at once to mine into leaf, stem or tuber as the case may be.

The feeding period of the caterpillars ranges from 14 to 69 days. The longer period usually occurs in the storage house at low temperatures. The period of pupation varies from 8 to 56 days.

Amount of Injury.—As a rule, the injury caused to the plant itself is not serious, though under certain conditions the yield may be seriously reduced. The chief injury comes from tuber infestation, see Figure 70. The caterpillars burrow through the flesh of the tuber, rendering it unsaleable.

Control Measures.—(1) The destruction by burning of all affected tubers as soon as they can be collected after digging, (2) good rotation. (3) good moulding to protect the tubers, (4) digging as soon as the crop is ready. It is to be hoped that control measures will not be required in this country.

WIREWORMS.

The wireworm is probably the commonest and most widely distributed of all the insect pests in this country. A special Leaflet No. 10, dealing with this insect is published by the Department and may be obtained free.

As is well-known the wireworm is the larva of the Clickbeetle. The female beetle lays her eggs in early summer beneath the surface of the soil, usually on grass land. The wireworms which hatch out from the eggs may remain as long as five years in the soil feeding on the stems and underground parts of plants. Almost all kinds of crops are attacked and the potato is no exception. Tubers are often made unsaleable by the ravages of this little brown larva. Small holes may be seen on the outside, but when the tuber is cut the wireworm's tunnels with blackened edges are found in the flesh of the tuber.

The writer once saw a field planted with cut sets, where practically every set failed through being eaten by wireworms. Many "misses," especially where cut sets are used are caused by this pest.

The wireworm after an active life of 4 or 5 years goes deeper into the soil, and enters the pupal stage for 3 to 4 weeks when it hatches into the mature beetle.

Wireworms are hardy but they cannot resist drought, and to avoid it they can go more deeply into the soil. They can live for some months in a soil without any crop. Successful control measures are hard to suggest, though some steps may be taken that will reduce the risks of damage. Wireworms are likely to be most plentiful when old lea is broken up. The ground should

be ploughed as early as possible, the earlier the better. If potatoes must be planted on the lea, which is not a usual procedure, all that can be done is to keep the soil stirred as often as possible to give birds every opportunity of feeding on the wireworms.

Where a regular rotation is followed and the land is not left more than three years in grass, a crop of oats being then taken, it is not often that serious damage to potatoes is caused by the wireworm.

APHIDES OR GREENFLY.

The appearance of Greenfly, so named on account of the colouring of some of the species is pretty generally known; they are usually to be seen in this country on leaves of the rose tree during a dry, warm summer.

There are at least four species which attack the potato plant, but only an expert can distinguish them.

One species, known as *Myzus persicae*, is the principal distributor of the Leaf Roll Virus and also of Virus Y which causes Leaf Drop Streak in certain varieties. Unfortunately, no investigation work has been done in this country to find to what extent this particular insect occurs in Ireland.

Maldwyn Davies found, contrary to general belief, that in Wales *Myzus persicae* was present in some districts at high altitudes, while in other places it was rare almost at sea level. He also found that this insect was very inactive under cool or moist or windy conditions.

Greenfly have not up to the present become so troublesome in this country on the potato crop as to justify spraying with paraffin emulsion as is sometimes done with rose trees.

If the potato leaves are well coated with the ordinary spraying mixture, they are distasteful to the greenfly, though this does not always stop their operations. It is well to remember that greenfly do not cause Leaf Roll or any other virus disease, they act only as distributors, so that if there are no diseased plants in the vicinity, the greenfly cannot spread the viruses. Ladybirds should be regarded as most useful insects and should never be destroyed as their larvae feed chiefly on greenfly. In a paper just published by Dr. Maldwyn Davies in *Scientific Horticulture*, 1937, some further very interesting facts regarding greenfly and *Myzus persicae* in particular are given.

Aphides in general survive the winter as eggs on woody plants. *Myzus persicae*, the most important distributor of Leaf Roll and several other viruses, selects the peach and nectarine, but Davies considered that these two trees are too rare to provide a hatching ground for the large numbers of winged individuals that he found on potatoes in spring. A search for over-wintering *Myzus persicae* on such trees as plum, sloe and hawthorn was unsuccessful, but in December, 1931, a chance inspection of consignments of savoys in a provincial market showed the undersides of the leaves to be smothered with wingless adults and young of this species. Since then examination of crops of

savoys, and indeed of most members of the cabbage and turnip family, has always revealed quantities of wingless forms of this species. According to Davies, there can be no doubt, then, that *Myzus persicae*, in addition to over-wintering in the egg stage, does quite generally pass the winter as wingless females on cabbage, turnips or members of that family of plants and these females are in fact the main source of this species in spring.

Experiments were conducted to ascertain the precise effect of the separate meteorological factors upon migration of the insects. The results are extremely interesting. It was found that the following combination of factors seemed to be necessary to stimulate free flight : temperature, not lower than 65°F. (fairly warm weather); humidity, not higher than 70 per cent. (dry weather); wind velocity, not higher than about 5 miles per hour (calm weather). In short, warm, dry, calm weather is required to encourage the greenfly to disperse themselves. For this reason it is obvious why the spread is small along the west coast of Ireland, as those acquainted with the country know that every day there is usually wind or rain, and while the temperature is usually cool it seldom drops to freezing point, even in winter.

Davies also showed that in Flintshire, on the east and much the drier side of Wales, greenfly were very plentiful and the spread of virus infection rapid, while in Anglesea and South Carnarvon, in the west with a much moister climate and frequent sea-mists, greenfly are scarce and the spread of virus infection almost negligible. When the winds and mists from the Irish sea have such a noticeable effect on the greenfly population of Anglesea, it can well be understood what the effects are of the full Atlantic gales on the west coast of Ireland. In conclusion, Davies states : "The investigations in North Wales, supplemented by the recent survey in Scotland, support the belief that no district in this country, where potatoes can be grown on any appreciable scale, is free from aphides, including the important insect vector *Myzus persicae*. The former contention that altitude was essential for low aphis infestation is not valid, since some of the smallest infestations recorded have been almost at sea-level. The view that northerly latitude was associated with freedom from aphides is not supported by observations, since as far north as Morayshire, an index figure of 901 aphides per 100 leaves was recorded." This figure might be compared with the numbers found in North Wales. " Each year since 1928 the index figure of population, in the districts where the spread of virus diseases has been rapid, has exceeded 100 *Myzus persicae* per 100 leaves. Even in seasons of low infestation such as 1931, 1935 and 1936, the figures in mid-July were 125, 189 and 163, respectively. In seasons of high infestations such as 1932 and 1933, the index figure was 1,300 and 800 *Myzus persicae* per 100 leaves, respectively. In districts where there has been no increase of virus infection among the stocks, the index figure even in 1933 only attained 90 per 100 leaves and with that exception it has never exceeded 20 *Myzus persicae* per 100 leaves in mid-July (the peak period) and more commonly has been nil on that date."

These insects are included amongst potato pests, not on account of the actual damage that they themselves cause to the potato plants, but because they are the principal distributors of some of the most important virus diseases. No practical measures for their control on a field scale has yet been devised, nor indeed are control measures usually necessary in this country, but growers would be well advised to avoid as far as possible having savoys or other members of the cabbage family overwintering too near to fields in which seed potatoes are grown.

CAPSIDS AND JASSIDS (LEAFHOPPERS).

There are several species of these two families but so far as the grower is concerned they may be grouped together. All are sucking insects, and feed by inserting their "beaks" into the substance of the leaves and sucking out the juice.

Two species of Capsid Bugs are found feeding on potato plants in this country: one, named *Calocoris bipunctatus*, is known as the "Potato Bug." It has a length of about one-quarter inch and is about one-tenth of an inch wide: it is green in colour and clothed with rather thick black hairs. The second species, *Lygus pabulinus*, is slightly smaller, though to an almost imperceptible extent, and is green in colour and clothed with pale hairs. Both species possess two pairs of wings which lie quite flat on the back when the insect is not flying. The part of each front wing nearest the body has a leathery texture, but the tip is transparent, as is also the whole of the hind wing. The head carries a tube-like sucking "beak" through which the sap is sucked from the leaves. The head has also a pair of feelers made up of four segments.

Capsids feed upon both sides of the leaves, the young leaves and shoots receiving most attention. Apart from the purely mechanical damage done by both species, the saliva of these bugs has a very poisonous effect on the potato plant, so that wherever a puncture is made in the leaf the portion surrounding the puncture dies and gives rise to an effect as if a charge of shot had been fired through the leaves—see Figure 71.

The Jassids or Leafhoppers are slender insects, broadest at the head-end, and tapering backwards, pale green in colour, and about one-eight inch long. They quickly jump away when disturbed. In America Leafhoppers cause serious damage, and bring about a trouble known as Hopperburn. When Jassids puncture a leaf for feeding purposes they produce only white spots. Unlike Capsids they seldom attack the shoots. Both Capsids and Jassids were reported by Murphy to be very numerous on the potato plants in his trials at the Albert College Farm, Glasnevin, in July, 1931. As a result of experiments conducted by him in that year, he was convinced that these insects were able to transmit Leaf Roll, but opinion is not even now, unanimous on this point. Kenneth Smith is of the opinion that next in efficiency to the Aphididae (Greenfly family) for virus transmission come the Jassidae. He believes that the Capsidae, although a very numerous group of plant-sucking insects, are little concerned with virus transmission.

Fig. 71.—Capsid Bug injury. Potato leaf showing injury caused by Capsids. (See p. 102.)

Fig. 72.—Rosy Rustic Moth. A potato stalk cut longitudinally showing the caterpillar of the Rosy Rustic Moth burrowing in its interior. (See p. 103.)

These insects pass the winter in the adult stage hidden beneath weeds and other rubbish, and especially under cover about the fences; they appear in spring when they deposit their eggs. It may be noticed in any potato field where these insects are present, that they cause far more damage to the plants nearest the fences, and usually the larger and wider the hedge the greater the insect injury. To control these insects all that can be recommended to growers is to clean up the fences around potato fields, and leave as little cover for insects as possible; all weeds, old potato stalks, etc., should be burned. A good coating of the ordinary spraying mixture makes the leaves very unpalatable to all insects.

INSECTS WHICH OCCASIONALLY INJURE THE POTATO CROP.

Leatherjackets, the larvae or grubs of the Crane-fly or Daddy-long-legs sometimes injure the potato tubers, but they cannot be regarded as a serious potato pest. See Department's Leaflet No. 51.

Rosy Rustic Moth (*Hydroecia micacea*). The caterpillar of this moth was found by Pethybridge in 1914 destroying potato stalks and causing symptoms which might, on casual observation, be mistaken for those of Black Leg. The way in which it burrows out the central portion of a potato stalk is illustrated in Figure 72, and the hole through which it made its entry is clearly seen.

Theobald reported the presence of this moth in Ireland in 1903, but its occurrence is rare.

Stewart MacDougall in the Highland Society's *Transactions*, 1917, says "The moth is not an uncommon one, and is found flying in the autumn. The caterpillar is found from June on to the autumn. The colour of the caterpillar is pinkish grey-brown or purplish brown, the under-surface being pale; all over the body is a series of black dots or warts from each of which a bristle springs. The caterpillar has sixteen legs of the pale colour of the under-surface of the body. The pupa is brown and is found in the soil."

Several cases of attacks by this caterpillar have been reported in England from time to time, but there is very little risk of this insect causing serious loss.

One case of attack in Ireland was also found by Pethybridge in 1909 by a nearly-allied species, the Frosted Orange Moth (*Gortyna ochracea Hb.*) but no other case has since been reported.

Death's Head Hawk Moth (*Acherontia atropos*) or the *Potato Sphinx*. Stewart MacDougall refers to this moth on several occasions since 1914 in the *Transactions* of the Highland Society of Scotland. He says: "This is the largest and most striking moth in Britain, sometimes reaching nearly six inches in spread

of wing. The moth has received its name from the markings on the upper side of the thorax, which resembles a human skull. The scientific name is equally suggestive, Acheron being a river in Hades, and Atropos one of the Fates. The moth can give out a shrill sound like the squeak of a mouse, while the caterpillar "gnashing its teeth" makes a grating noise, recalling the snap of an electric spark. The moth, though it has been taken in Britain from north to south is not common. The caterpillar rests in the daytime, and feeds at night on potato and allied plants. In colour it is yellow-green, speckled with purple; there are seven oblique violet stripes on each side, meeting on the back; spiracles black; from the back of the second last joint a rough granular horn projects; the legs are 16 in number; the length of the caterpillar when extended is up to five inches. There is a brown variety of the caterpillar, dotted all over with white spots, and having the oblique stripes on the sides brown in colour. The full-grown caterpillar enters the soil for pupation. The pupa is brown or chesnut-brown, and has no cocoon round it. This moth has also been known to invade bee hives, it is apparently very fond of honey. It is so rare in this country, there is little risk of its ever becoming a pest. A few specimens are found in Britain each year, and they occurred in unusual numbers in the dry seasons of 1933 and 1934. If a grower happens to meet with this moth or its caterpillar, there is no need to become alarmed.

Cutworms are the larvae or grub stage of the Heart and Dart Moth (*Agrotis exclamationis*) and of the Common Dart Moth (*A. segetum*). They resemble, and are liable to be mistaken for Leatherjackets, the larvae of the Daddy long-legs or Crane-fly, but the Leatherjacket has no legs while the Cutworm has three pairs near the head end, four pairs about the middle of the body and a foot at the tail end. Wireworms are sometimes called "cutworms" in this country, but they, too, are quite distinct from the true Cutworm. No case of damage by the true Cutworm to potatoes has been reported in this country, though in England a few cases usually occur each year. They bite the stem through near the surface of the ground. Damage is caused chiefly while the stems are young and soft.

Good cultivation and the adoption of a good rotation are likely to be all the remedial measures required in this country. If, however, Cutworms were found causing damage on a small scale they could be collected by hand, as they are found just below the surface of the ground. On a large scale they can be destroyed reasonably well by mixing thoroughly 1 lb. Paris Green with 20 lbs. Bran and sowing the mixture around the stems of the plants. Paris Green is a dangerous poison, and must be very carefully handled.

Potato flea-beetles (*Psylliodes affinis*) are fairly common in the drier parts of Great Britain and Ireland. They are very small black insects, about one-twentieth of an inch in length, and jump when disturbed. They belong to the same family as the well-

known "Turnip-fly." They injure the potato plants by eating holes in the leaves. They seldom cause serious injury in Ireland, but are very troublesome in parts of America where the larvae occasionally do injury by mining into the tubers and cause "pimply" potatoes. In the hot dry summers in some States, they often become the worst enemy of the potato. The adult insects live over winter under leaves, rubbish, clods, etc., and appear in May and early June.

In Ireland they can best be controlled by keeping the fences clean and well trimmed so as to leave as little cover as possible, by good cultivation and by applying a good coating of the ordinary spraying mixture to make the leaves unpalatable. These insects have often done damage before the first spraying is applied. The beetles are never so noticeable where a good rotation of crops is practised.

Earwigs (*Forficula auricularia*) have been known to cause some damage to potato tops, but they have never caused any appreciable loss in this country. They are, however, very troublesome in America, where they were introduced from Europe. D. W. Jones recommended for treatment on a wide scale a poison bait of mixed Paris-green and stale bread, 1 part of Paris-Green to 16 parts of finely ground stale bread. This is wetted, and thrown broadcast where the earwigs are troublesome. This bait should be laid after dusk. Fortunately, no such measures are, as yet, necessary in this country.

Slugs have been known to cause considerable damage to tubers even in the field. They frequently cause damage to tubers in gardens, but as a rule it is only in an occasional season that their presence is noticed in the field. Small holes, though decidedly larger than those produced by the wireworm, are observable on the outside of the tuber. When the tuber is cut, part, sometimes the greater part, of the interior is eaten away. The Grey Field Slug is the worst offender. Ducks, especially young ones, eat slugs freely. Treatment on a field scale is very difficult, but fortunately is rarely required in this country. A good coating of the ordinary spraying mixture will keep slugs from the plants, but no treatment so far has been found successful in preventing the slugs from damaging the tubers. For treatment on a large scale a mixture of 5 lb. finely ground Copper Sulphate and 1 cwt. of Kainit applied at night, after dusk has been found most successful. Artificial light is of course required for applying the material.

Millipedes are well named the "Thousand-footed," as their bodies are divided into a large number of segments or rings; on each of the first three rings there is a pair of legs, and all the succeeding rings bear two pairs. The "feelers" are short. There are several species of Millipedes, but the only one that does any damage goes by the name of the Julus Worm. It is about half-an-inch long, creamy-pink in colour with a row of bright pink spots along each side of the body. This Millipede causes some damage to roots and tubers, but except in some gardens it is never present in sufficient numbers to cause any appreciable injury.

GENERAL SUMMARY.

Prevention and Control of Potato Diseases and Pests.

Diseases and pests could very often be completely avoided, or at the very least kept under good control if seed potato growers were to adopt the following suggestions which can readily be put into practice:—

1. Follow a good rotation, and keep as long a period as possible between successive potato crops.
2. Use only clean, healthy seed from a really reliable source. Bring no seed on to the farm, except the produce of healthy crops grown on clean land. Sprout all seed before planting.
3. Never allow potato tubers affected with any disease to be left lying about or to get into the manure heap. Always have them collected and boiled, burned or otherwise safely disposed of.
4. Burn old stalks and weeds as soon as possible after the crop is dug. Never cover potato tubers with stalks or foliage even temporarily.
5. Keep fences clean and well trimmed, so as to leave as little cover as possible for insects.
6. Spray thoroughly, early and often, as, apart from Blight, the spray is distasteful to insects.

This principle ought ever to be kept in view, that in a good cause, nothing can resist industry and perseverance.
—Sir John Sinclair, 1793.

SECTION V.—PRODUCTION OF "HEALTH STOCK" SEED POTATOES.

"Health Stock" seed may be defined as seed that is free from every known type of virus disease. Care is taken to see that the seed is also free from Black Leg, and Verticillium Wilt. No "Health Stocks" are grown where Wart Disease or Eelworm was ever known to exist. It is not yet possible to guarantee complete freedom from Common Scab, Powdery Scab, Black Scurf and Skin Spot, as there is no satisfactory remedy for these diseases. If, however, during the regular inspection of seed potatoes for export, an appreciable amount of any of these four diseases, or any other disease is found to be present the seed cannot be exported.

The "Health Stocks" in the Irish Free State have mostly been built up from individual plants tested for freedom from virus disease in the Plant Pathological Laboratory, Glasnevin, attached to University College, Dublin. The plants are tested for freedom from virus diseases by grafting cuttings from the plant under test on to healthy plants of such varieties as President

and Arran Victory. If the cutting contains any virus disease, President or Arran Victory will develop symptoms of the virus disease. This system of testing is necessary in order to start on a sure foundation. The majority of varieties are "carriers" of some form of virus disease, i.e., though the plant is actually affected no external symptoms are apparent. It would be most undesirable to use such a plant for the production of "Health Stock." No variety is a "carrier" of the Leaf Roll Virus, but, for example, Up-to-Date and Arran Banner are "carriers" of Virus B, and Di Vernon is a "carrier" of Virus Y, one of the worst viruses. Again, during dry weather or on bright sunny days the symptoms of Virus X in certain varieties may be masked. For these reasons, if at all possible, the foundation plant or plants for the production of "Health Stocks" should be laboratory tested plants. If, however, no such plants can be got, the next best thing is to mark with stakes a few plants in a portion of the field where very little virus disease appeared and where any suspicious plant was removed. Plants shewing the following features should be chosen:—

(a) Plenty of vigour;

(b) Leaflets large, flat, uniform dark green colour, no puckering.

(c) Plenty of bloom in the case of a flowering variety, but, of course, not so much as would cause suspicions of a "Bolter."

The selected plants should be dug as soon as the tubers are about hen-egg size. The produce of each plant must be kept separate. The tubers should be kept in good light until they are well greened. They can then be stored in the usual way, and will keep quite well.

Whether the tubers are from tested plants, or only from selected plants, the produce of each plant must be grown in the following year in isolation preferably amongst turnips or mangels, but can be grown anywhere except adjacent to other potatoes. It is necessary to grow them well removed from a fence where there is always more risk of insect injury. When the turnips or mangels have been sown, a few yards of a drill can be opened with a shovel and all the tubers from one plant dropped in succession. This operation is repeated elsewhere in the field for the tubers of all the other plants. The greater the distance between the unit selections the better. The growing plants in each unit should be examined for virus disease as frequently as possible, but at least once a week from the time they come above ground until mid-August. If one plant in a unit looks suspicious the whole unit should be immediately rooted out. If no trouble arises the produce of all the plants may be bulked at the end of the first season, and again grown in isolation, as far away as possible from other potatoes, in the following seasons, and this procedure repeated until a sufficient quantity is available to plant the whole crop of that particular variety. A special officer superintends the production of "Health Stocks". Nucleus stocks of most of the commercial varieties

are grown in County Donegal under his direct supervision. Small quantities of this seed are available each year for distribution amongst careful growers in the best seed districts.

"Health Stocks" can be grown only in the best seed districts, and in districts where potato-growing is not very intensive.

There has been very little trouble in keeping the nucleus stocks perfect, but when the "Health Stocks" are grown under field conditions many mishaps have occurred. Such disappointments are, of course, bound to take place, until more information in regard to the spread of the virus diseases is available, and until greater precaution is taken by the grower.

Freedom from Leaf Roll and the various forms of Streak disease is easily preserved, but Simple Mosaic, Interveinal Mosaic and indeed even Crinkle turn up from no one knows where. Virus X is the principal cause of these diseases, and so far it is not known how Virus X spreads.

Though complete success cannot be claimed, yet the work already done has resulted in a wonderful improvement in the stocks in general compared with those in existence some ten years ago when this work was begun. Take the case of Majestic. Plants were most irregular, a high plant, a low plant, a sprawling plant, etc., etc., following in succession, were typical of the crop. Now-a-days the plants are uniform in height, etc., from one end of the field to the other, and uniformity is the best of all features to indicate the right stock.

The best place to grow "Health Stocks" is where good isolation can be secured in a bleak wind-swept district with a cool moist climate, a heavy rainfall and free from long dry periods. A high-lying mountain patch is ideal, see Figure 73. There is not the slightest doubt, but that the demand for "Health Stock" will increase, and the time will come when nothing else will be purchased, until all the "Health Stock" has been sold. The acreage under such stocks is likely to remain very restricted until such time as growers are prepared to give every possible care and attention to their crops. It is true that sufficient isolation is often impossible in intensive potato-growing areas.

Crops certified as "Health Stock" are shown separately in the List of Certified Crops published annually by the Department of Agriculture.

SEED SUBSIDY SCHEME.—Several County Committees of Agriculture allot annually a sum varying from £25 to £150 to assist growers in the purchase of "Health Stock" seed, or seed of new varieties, the produce of such seed being re-sold to other growers in the county concerned. This Scheme has been of great assistance in the distribution of good seed. Conditions for the purchase of seed under this Scheme can be obtained from the Secretary of the County Committee of Agriculture for the county in which the applicant resides, or from the local Potato Inspector.

Fig. 73.—" Health Stock " being grown in good isolation. (Drills in fore ground are sown with turnips.)

(See p. 108.)

Fig. 74.—Typical tuber of new variety, "Ulster Monarch." (See p. 232.)

A man must know much to know everything.
—Charles Varley, 1770.

SECTION VI.—IDENTIFICATION OF VARIETIES.

Varieties are distinguished by characteristics of:—
Tuber,
Sprout,
Foliage,
Flower,
Date of Maturity.

Another characteristic has now been added for the first time, viz.: Disease Resistance. It is only within recent years that the importance of this feature has been fully appreciated, thanks in the first instance to Wart Disease. This feature will be dealt with in due course.

Tuber.—Tubers may vary in the following features:—

(*a*) **Shape**—Tuber shapes are usually classified as round, oval and kidney.

The term "round" is applied, even when the tuber may be only approximately spherical, indeed a contradiction in terms is used when some tubers, Great Scot for instance, are described as "flattened round." There is no clear cut line between round and oval, or between oval and kidney. Some tubers frequently classed as oval (egg-shaped) might be more correctly described as "oblong," e.g., Ally. "Kidney" tubers include what may be termed "long oval," see Figure 74, as well as pear-shaped tubers, i.e., those which taper towards one end. It should be noted that in every variety tubers will be found not typical of the variety.

(*b*) **Colour of Skin**—The colour of the skin may be white, yellow, purple, pink or red, white or yellow with pink or purple splashes. The colouring appears sometimes only in the eyes. The depth of colour varies very considerably in some varieties according to the nature of the soil in which they are grown. Bog soil produces the deepest colour. "Sports" occur from time to time varying considerably from the normal type. A Kerr's Pink with the skin partly pink and partly purple, and another tuber with the skin all purple, a Champion with a purple skin, an Arran Victory with an almost white skin, a Beauty of Bute with a pink skin, etc., have been found.

Many white-skinned varieties give rise to russet-skinned types, the best known being Maincrop which gave rise to Golden Wonder, Up-to-Date gave rise to Field Marshal, Great Scot to Sefton Wonder, etc.

(*c*) **Flesh**—The colour of the flesh is sometimes a useful guide though the great majority of varieties are white fleshed. Between the snow-white flesh of Snowdrop and the deep yellow of Champion there are all gradations, those midway between having their flesh described as lemon.

(*d*) **Eyes**—The eyes may be shallow, medium or deep. The position of the eyes on the tuber is sometimes worth noting. Duke of York has the eyes mostly on the point of the tuber, Great Scot on the shoulder of the tuber, while the old Lumper, see Figure 75, has eyes dotted over the tuber.

The distinctness or otherwise of the eyebrow is occasionally worth noting.

The underground stems or stolons in the case of some varieties notably Abundance show a distinct purple colouring.

In the great majority of cases it is impossible to identify a variety from the tuber alone.

Sprout.—The colour of the sprout is a most reliable mark of identification, and when seed is sprouted mixtures can often be removed without difficulty.

Sprouts are purple or pink in varying depths of colour. The sprout of British Queen is, for example, faint pink at the base with a white tip, while Great Scot has a deep pink sprout. The colour of the sprout of each variety is given later. The depth of colour varies to some extent with the amount of exposure to light. Long exposure to bright light will, of course, make the sprouts green, and render differentiation impossible. Under ordinary housing conditions, no difficulty will be experienced in identifying the colour. The colour of the sprout corresponds with any colour present in the skin of the tuber. Furthermore a variety with a blue-purple flower will have a purple sprout, while a variety having a red-purple flower will have a pink sprout. The strength and thickness of the sprout are also a guide.

Again some sprouts that may be identical in colour can be distinguished by the presence or absence of fine hairs. The sprout of Arran Comrade is covered with such hairs, whereas the sprout of Arran Chief is practically free from them. Diseased tubers can often be noticed by their premature sprouting.

Foliage.—Foliage characteristics are the most important means for the identification of varieties. In most cases it is possible to recognise varieties from the foliage alone. The following features of the foliage serve as means for identification:—

(*a*) **Haulm**—The haulm may be tall or short, upright or spreading, stiff and erect or drooping and straggling, strong or weak, etc., Golden Wonder and Kerr's Pink

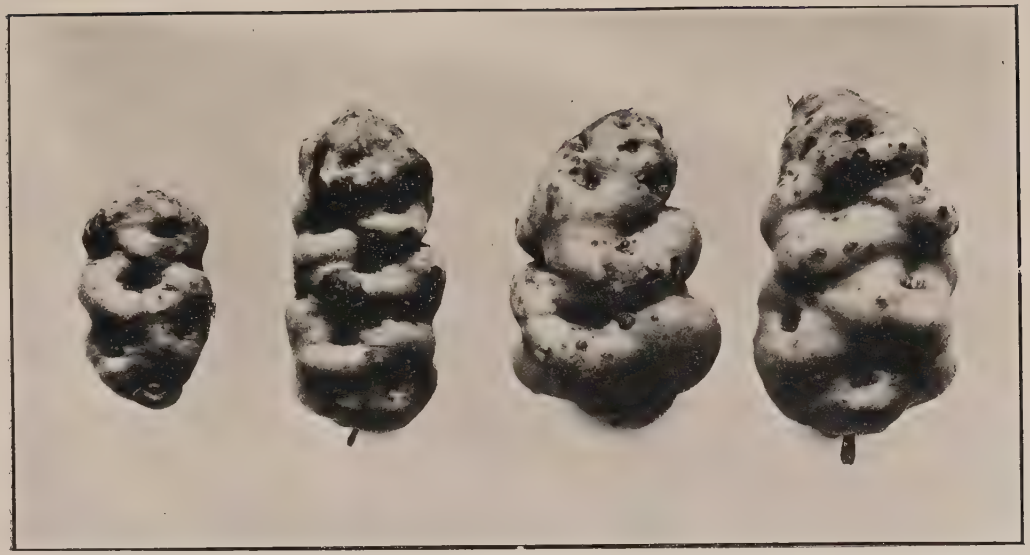

Fig. 75.—Typical tubers of very old variety, "Lumper." (See p. 198.)

have erect tall foliage while British Queen has spreading foliage. Many varieties, such as Duke of York, show a pronounced straggling habit of growth when the plants are affected with some of the virus diseases.

(*b*) **Stem**—Stems of different varieties vary considerably in colour. Varieties having coloured tubers develop most colour in the stem though Epicure and Eclipse with white tubers develop almost as much colour as any coloured variety. As might be expected, stems of plants that are well exposed to bright light, such as those in an outside drill or at the end of a drill, develop more colour than those shaded by other plants.

Stems also vary in number, thickness, hardness and branching or non-branching habit. The Champion produces a large number of thin wiry stems. Most varieties have hollow stems, except Eclipse which has a solid stem until the plants are beginning to ripen.

The stem possesses one very useful point for identification purposes. The stem is not round, but more or less three-sided and at each angle a projecting ridge, known as *the wing* runs up the stem. The edge of this ridge may be quite straight and even like a knife edge, or it may be wavy or wrinkled. This feature was first made use of as an infallible test between the immune variety Great Scot, which had a straight wing, and the very susceptible variety Arran Chief which had a decidedly wavy or wrinkled wing. The two varieties bore a strong resemblance in many respects. Some varieties have a very broad wing, notably the old variety Beauty of Bute. The wing is sometimes double as is very noticeable in the old variety Sack-filler.

(*c*) **Leaf**—The potato plant has a compound leaf, made up of a number of leaflets attached in pairs to a central midrib with one terminal leaflet.

There is also a number of much smaller leaflets known as secondary leaflets attached to the central midrib, and in some varieties also to be found on the leaflet stalks.

The leaves of some varieties are much closer and more compact than others due to (1) the extra development either in size or number, or both, of the secondary leaflets, or (2) to there being a shorter space between each pair of leaflets on the central midrib, or (3) to the length of the stalk of the leaflet. Arran Crest has a very *open* leaf, see Figure 76, while Up-to-Date has a close leaf, see Figure 77. Sharpe's Express has a very close leaf due to the very large number of secondary leaflets. In several varieties it is difficult to say whether the leaf should be classed as "open" or "close," but it is often a useful distinction.

The following points in regard to the leaf should be noted:—

Length of Leaf.—The lower fully developed leaves should be noted. While City and Arran Crest have long leaves, President has a short leaf.

Erect or **Arched Appearance of Leaf.**—Some leaves are stiff and erect such as Black Skerry, while others assume the shape of an arch, the latter type being more general.

Number of Leaflets in each Leaf.—As a rule most varieties have three well-developed pairs of leaflets while a few such as President have only two such pairs.

Position of the Leaflets in regard to the Central Midrib.—The leaflets sometimes stand out at right angles from the central midrib, while in other leaves they come off at an acute angle and point forward. In such cases the first pair often overlap the terminal, and the latter may become united to them, when the terminal is said to be "tied." This condition is very common in International Kidney, the variety generally grown in the Channel Islands.

Leaflets vary in size, shape, colour (dark or light green, greyish green, bluish green, yellowish green), hairiness or otherwise of the surface, dullness or glossiness, and a smooth or wrinkled surface.

Colour of Central Midrib.—The amount or the absence of colouring on the central midrib and on the leaflet stalks should be noted.

Secondary Leaflets.—The very small leaflets, known as secondary leaflets, which are found attached to the central midrib or sometimes to the leaflet stalks, vary in size, shape and number and are often a useful point of differentiation.

Flower.—The flower, if present, affords one of the most obvious means of identification. There are, of course, rare cases of varieties such as Up-to-Date and President which normally have red-purple flowers, producing white flowers. Such cases are so rare that plants producing "freak" flowers may be treated as "rogues." Flowers may be white, purple or almost blue.

White Flowers.—There are slightly different shades of white, but as a rule in practice the only points that can be observed are the presence of green tips observable in Arran Chief and some other varieties, and a slight trace of colour on the back of the petals as in Flourball and Shamrock.

Purple Flowers.—Purple flowers show two shades of colour that are usually fairly apparent, one in which blue predominates when the flowers are said to be blue purple, and in the other

Fig. 76.—"Open Leaf." (See p. 111.)

Fig. 77.—Close Leaf. (See p. 111.)

red predominates, producing red-purple flowers. There are many variations of shade, Champion has a decidedly blue-purple flower, while the deepest share of red-purple is shown by Sharpe's Express and Bishop.

Blue Flowers.—No potato flowers are pure blue, but those of certain varieties are almost blue. In fact comparison with a colour chart is necessary to show that they are not blue. No common variety produces a "blue" flower, but some of the rarer varieties produce such flowers:—Cavan Lumper, Sharpe's Victor, Blight Resister, Bloomers, Buffs, Dunvegan, etc.

Apart from the colour of the flower, or strictly speaking the colour of the corolla, many other important points of difference may be discerned.

The flower of the potato, like most flowers, is made up of four parts named as follows:—

(*a*) Calyx comprised generally of five sepals;
(*b*) Corolla comprised generally of five petals;
(*c*) Stamens or male portion of the flower;
(*d*) Pistil or female portion of the flower.

(*a*) **The Calyx,** or outer portion, is the part seen before the bud opens. It shows variations in colour. The buds of Irish White and Northern Star are remarkably green. Arran Chief and Great Scot, Peerless and Arran Victory can be distinguished by the difference in the colour of their buds.

The *sepals* also show variations in their length, presence or absence of hairs, etc.

(*b*) **The Corolla** or brightly coloured part of the flower varies in the colour and in the size and occasionally in the number of the *petals*. The tips of purple-coloured petals are always light in shade, and often distinctly white. The colour must be examined in a newly-opened flower, as it soon fades when exposed to strong light. Flourball, Irish White, Bloomers, May Queen, etc., have very large petals while Golden Wonder has small petals. The number of petals in the flower of May Queen varies, four only often make up the corolla.

(*c*) **A Stamen** consists of a short thread-like stem with an elongated bulbous top known as the *Anther*. The anthers usually number five, and may vary in colour from orange or deep yellow to a very pale yellow. This variation in the colour of the anthers is a very useful means of identification, for the colour in any particular variety is very consistent though occasionally deep yellow and pale yellow anthers have been seen on the same plant. This was noticed in Early Rose and Champion,

The anthers are sometimes malformed, and when this is the case they are always pale in colour.

The anthers of Arran Victory are pale and malformed while those of Peerless are deep yellow and regular. Many varieties have malformed anthers.

Occasionally an anther develops into a petal. The variety, Lord Roseberry, frequently shows this peculiarity.

(*d*) **The Pistil** consists of a small bulb (the *ovary*) with a protruding stem which is called the *style*. The flattened top of the style is known as the *stigma*. The length of the style, and the distance which the stigma protrudes beyond the top of the anthers are sometimes useful guides, compare British Queen and Abundance.

The new variety Dunbar Standard possesses the very unusual feature of a twisted style.

Inflorescence.—The number of flowers in the inflorescence may be noted, though this is not a consistent character. In several cases, e.g., Ally, only one flower is generally formed, in other varieties, e.g., Up-to-Date as many as a dozen may be produced. The flower stalk and the inflorescence stalk called here the flower cluster stalk should be noted, as they vary in length, strength, colouring and hairiness.

Again some varieties do not bloom at all white others bloom very freely. In certain seasons all varieties, and even those which do not usually bloom, produce flowers much more freely than normal. A damaged haulm will often produce bloom, when the uninjured haulm will not do so. This was noticed in the case of Great Scot, King Edward and Sharpe's Exuress.

A "Bolter" always blooms much more freely than the normal plant. On the other hand some diseases, such as Witch's Broom, prevent blooming, and other diseases, Crinkle, etc., reduce the amount of bloom.

Berries.—Some varieties produce berries naturally while others never do so. The variety Bloomers produce berries like clusters of grapes, Herald and Flourball produce berries freely.

Date of Maturity.—Two varieties that resemble each other closely may often be easily distinguished if one happens to ripen earlier than the other. By this means the variety Arran Chief could readily be detected in a crop of Great Scot.

Disease Resistance.—This characteristic of varieties has not previously been included, and indeed its inclusion now only shows how defective information is at present on this very important question. Thanks to the work done on Wart Disease, it is possible to state whether a variety is or is not immune in the field to this disease, but so far as other diseases are concerned the small amount of information that it has been possible to collect is given later with the other characteristics of each variety. It is hoped through time that the reactions of all the important commercial varieties to all the common diseases will be recorded.

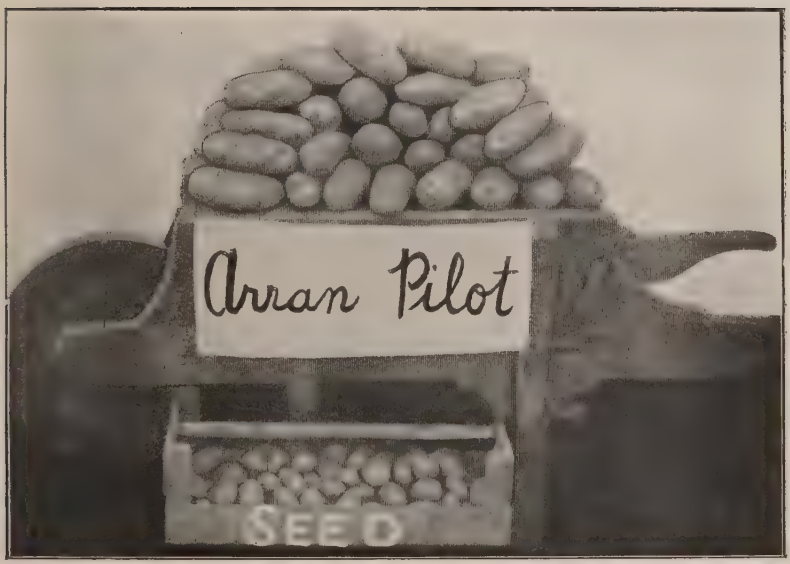

Fig. 78.—The result of planting healthy seed. (See p. 133.)

List of Names applied to Potatoes in recent years, their Immunity (I) or Susceptibility (S) to Wart Disease (Black Scab) and whether Distinct Varieties or merely Synonymous with some other Variety.*

Name.	Immune (I) or Susceptible (S.)	(D.) Distinct Variety or Synonymous with.
Abundance	I.	D.
Achievement	I.	D.
Adirondack	I.	D.
Advancer	I.	Bishop.
Advancer	S.	Eclipse.
Allanah	I.	D.
Allies	S.	Northern Star.
Ally	I.	D.
Alness	I.	D.
Alpha	S.	Sharpe's Express.
America	I.	Irish Cobbler.
Apple (Red)	—	D.
Ardcairn Beauty	I.	Beauty of Bute.
Ardneill Rose	I.	Early Mainstee.
Argyle Favourite	I.	D.
Arran Banner	I.	D.
Arran Beauty	S.	British Queen.
Arran Cairn	I.	D.
Arran Chief	S.	D.
Arran Comrade	I.	D.
Arran Consul	I.	D.
Arran Crest	I.	D.
Arran Early	I.	Abundance.
Arran Early	S.	British Queen.
Arran Hope	S.	Up-to-Date.
Arran Peak	I.	D.
Arran Pilot	I.	D.
Arran Rose	I.	D.
Arran Scout	I.	D.
Arran Signet	I.	D.
Arran Treasure	I.	Ally.
Arran Victory	I.	D.
Ashleaf Kidney	S.	Myatt's Ashleaf Kidney
Ballydoon	I.	D.
Barley Bounty	I	D.
Beauties	S.	D.
Beauties	I.	Beauty of Bute.
Beauty of Bute	I.	D.
Beauty of Hebron (Pink)	S.	D.
Beauty of Hebron (White)	S.	Puritan.
Ben Cruachan	I.	D.
Ben Lomond	I.	D.
Bishop	I.	D.
Black Bull	I.	Bloomers.
Black Champion	I.	D
Black Heart	—	Jersey Black.
Black Skerry	S.	D.
Blight Resister	S.	D.

* The meaning of the word "synonym" as used in relation to Potato varieties has been defined by the Ormskirk Synonym Committee as follows:—"Two varieties are considered to be synonymous when all such morphological features as can be recognised by an experienced observer, as well as all such physiological characters as can be determined by ordinary observation and experience, are comomn to both, in fact when the characters of haulm, flower and tuber, as well as maturity, resistance to disease and particularly immunity or otherwise to Wart Disease, are the same in both."

For names of important old varieties, see History of Potato Varieties, Jour. Dept. of Agr., Vol. XXXIII, No. 1.

Name.	Immune (I) or Susceptible (S.)	(D.) Distinct Variety or Synonymous with.
Blight Defender	S.	Green Champion.
Blight's Defiance	S.	Invincible.
Bloomers	I.	D.
Blue Grey	S.	D.
Blue Gloss	I.	D.
Blue Nebs	S.	D.
Blue Eyes	I.	Earl of Essex.
Bobbie Burns	S.	D.
Boston Kidney	I.	D.
Bravo	S	D.
British Premier	S.	Epicure.
British Queen	S.	D.
Brown Black	I.	Bloomers.
Brown Champion	S.	Green Champion.
Brown Rocks	I.	D.
Bruce	S.	Magnum Bonum.
Buchan Beauty	I.	D.
Buffs	I.	D.
Calico	—	D.
Cardinal	I.	D.
Catriona	I.	D.
Catriona Substitute No. 1	S.	D.
Catriona Substitute No. 2	S.	D.
Cavan Lumper	S.	D.
Champion	I.	D.
Champion II.	I.	D.
Champion, Black	I.	D.
Champion's Heir	S.	D.
Champion, Brown	S.	Green Champion.
Champion, Green	S.	D.
Champion, Skerry	I.	Buchan Beauty.
Champion, Striped	I.	Buchan Beauty.
Champion Gardenfiller	I.	Buchan Beauty.
Champion, Purple	I.	Champion Selection.
Champion, Wild	—	—
Champion Successor	I.	Like Early Market Bolters.
Cherub	S	Duke of York.
Chester Early	S.	Duke of York.
Claymore	I.	D.
Cleadon Park	S.	Red King Edward.
Clifden Seedling	I.	Champon II.
Climax	I.	The Towse.
Colleen	S.	British Queen.
Colonist	S.	Eclipse.
Colossal	I.	D.
Conquest	I.	D.
Conquest	S.	Up-to-Date.
Copper Duns	I.	Earl of Essex.
Corona	I.	D.
Coronation	I.	D.
Crimson Beauty	I.	D.
Crown Jewel	I.	Coronation.
Crusader	I.	D.
Cups	I.	Red Cups.
Cups, Gregor	I.	D.
Dainty	I.	Abundance.
Dalhousie	S.	Up-to-Date.
Dalmahoy	—	D.
Dargill Early	I	Boston Kidney.
Di Vernon	I.	D.
Dominion	I.	D.

Name.	Immune (I) or Susceptible (S.)	(D.) Distinct Variety or Synonymous with.
Don	—	D
Donard	I.	D.
Doon Early	I.	D.
Doon Pearl	I.	D.
Doon Star	I	D.
Dreadnought	I.	Colossal.
Dreadnought	I.	D.
Dreadnought	I.	Templar.
Dreadnought	I.	Great Ssot.
Duchess of Cornwall	S.	Up-to-Date.
Duke of Kent	I.	D.
Duke of Perth	I.	D.
Duke of York	S.	D.
Dunbar Archer	I.	D.
Dunbar Cavalier	I.	D.
Dunbar Rover	I.	D.
Dunbar Standard	I.	D.
Dunbar Yeoman	I.	D.
Dunnotar Castle	S.	D.
Dunaverney	I.	D.
Dunvegan	I.	D.
Earliest of All	S	Eclipse.
Earliest of All	S.	Sharpe's Express.
Earl of Essex	I.	D.
Early Favourite	S.	Sharpe's Express.
Early Manistee	I.	D.
Early Market	I.	D.
Early Ohio	S.	D.
Early Pink Champion	I.	D.
Early Puritan	S.	Puritan.
Early Regent	S.	D.
Early Rose	S.	D.
Early Templar	I.	D.
Eclipse	S.	Sir John Llewelyn.
Eclipse	S.	Up-to-Date.
Edgecote Purple	S.	D.
Edinburgh Castle	S.	D.
Edzell Blue	I.	D.
Edzell Blue Substitute	S.	D.
Eigenheimer	S	D.
Eightyfold	S.	D.
El Dorado	S.	Evergood.
Elephant	S.	D.
Elephant	S.	Pink Beauty of Hebron
English Beauty	S.	British Queen.
Epicure	S.	D.
Evergood	S.	D.
Express	S.	Sharpe's Express.
Factor	S.	Up-to-Date.
Farish's Pink Champion	S.	D.
Farmers	I.	D.
Farmer's Glory	I.	Earl of Essex.
Farmer's Glory	S.	Up-to-Date.
Field Marshall	S.	Russet Up-to-Date.
Fiftyfold	S.	D.
First Crop	S.	Sharpe's Victor.
Flounder	S.	D.
Flourball	I.	D.
Flowers of Faughart	S.	Oxford Early.
Fluke	—	D.
Fortyfold	S.	D.

Name.	Immune (I) or Susceptible (S.)	(D.) Distinct Variety or Synonymous with.
Gardenfiller	S.	Hibernia.
Garton's Potato	I.	Early Market.
Gawkies	I.	D.
General	S.	White-flowering President.
Gigantic	I.	D.
Gladstone	I.	D.
Glencoe	I.	D.
Golden Wonder	I.	Russet Maincrop.
Goldfinder	I.	Ally.
Goldfinder	I.	Great Scot.
Good Hope	S.	Up-to-Date.
Gordon Castle	S.	D.
Grampian	I.	Red Potato.
Great Scot	I.	D.
"Great Scot" Rogue	I.	D.
"Green Budded" Rogue	I.	Appears Distinct.
Green Champion	S.	D.
Green Mountain	I.	D.
Green Tops	I.	White or Brown Rock
Gregor Cups	I.	D.
Greys	I.	Buchan Beauty.
Greys	I.	Black Champion.
Guardian	S.	Royal Kidney.
Haddingtons	S.	D
Harbinger	S.	D
Herald	I.	D.
Herd Laddie	S.	D.
Hibernia	S.	D.
Home Rulers	S.	Hibernia.
Immune Ashleaf	I.	Juli.
Imperator	S.	D.
Incomer	I.	D.
International Kidney	S.	D.
Inverness Favourite	I.	D.
Invincible	S.	D.
Irish Chieftain	I.	D.
Irish Cobbler	I.	D.
Irish Elegance	S.	British Queen.
Irish Giants	S.	Irish White.
Irish King	S.	Up-to-Date.
Irish Queen	I.	D.
Irish Strain	I.	D.
Irish White	S.	D.
Jeannie Deans	I.	Abundance.
Jersey Royal	S.	International Kidney.
Jersey Black	—	D.
John Bull	S.	D.
Juli	I.	Immune Ashleaf.
Katie Glover	I.	D.
Keay's Champion	I.	D.
Kemps	—	—
Kepplestone Kidney	S.	D.
Kerr's Pink	I.	D.
Killeads	—	D.
King Edward VII.	S.	D.
King George V.	I.	D.
K. of K.	I.	D.

Name.	Immune (I) or Susceptible (S.)	(D.) Distinct Variety or Synonymous with.
Laing's Imperial	S.	Up-to-Date.
Lancers	I.	Red Potato.
Land Leaguers	S.	Hibernia.
Langworthy	I.	Maincrop.
Lapstone Kidney	—	D.
Leathers	I.	Brown Rock.
Leathercoats	I.	Brown Rock.
Leinster Wonder	I.	D.
Lochar	I.	D.
London Blue	S.	D.
Longkeeper	S.	Up-to-Date.
Lord of the Isles	I.	Great Scot.
Lord Roseberry	S.	D.
Lord Scone	I.	D.
Lord Tennyson	I.	D.
Lumper	I.	D.
Lymm Grey	S.	D.
Magnum Bonum	S.	D.
Maincrop	I.	D.
Mainstay	S.	British Queen.
Majestic	I.	D.
Marquis of Bute	I.	D.
Mauve Queen	I.	D.
May Queen	S.	D.
Mein's Chieftain	I.	The Towse.
Mein's Early Round	S.	D.
Merricks	I.	D.
Midlothian Early	S.	Duke of York.
Mighty Atom	I.	Tinwald Perfection.
Millar's Beauty	I.	D.
Mill Street Hero	S.	D.
Mons Star	S.	Red King Edward.
Mons Star	S.	King Edward VII.
Moore's Fancy	I.	Dreadnought.
Mr. Bresse	I.	D.
Myatt's Ashleaf Kidney	S.	D.
New Era	S.	D.
New Renown	I.	Abundance.
New Success	S.	Duke of York.
Ninetyfold	S.	D.
Ninetyeights	I.	Beauty of Bute.
Nithsdale	I.	D.
Norna	I.	D.
Northern Star	S.	D.
Open-Leaved Rogue from Kerr's Pink	—	D.
Orange-Anther Substitute	S.	D.
Ormsby Choice	S.	D.
Osborne Seedling	I.	Abundance.
Oxford Early	S.	D.
Ox Noble	—	D.
Paterson's Victoria	—	D.
Peacemaker	S.	British Queen.
Peacemaker	I.	Golden Wonder.
Peach Bloom	I.	D.
"Peelers"	I.	Red Rocks.
Peerless	I.	D.
Pink Eyes	I.	D.
Pink Eyes	I.	Beauty of Bute.

Name.	Immune (I) or Susceptible (S.)	(D.) Distinct Variety or Synonymous with.
President	S.	D.
Pride of Bute	I.	D.
Prince Albert	—	D.
Priory Queen	I.	Abundance.
Prolific	I.	Snowflake.
Prolific	S.	Up-to-Date.
Prosperity	S.	Up-to-Date.
"Protestants"	I.	Rocks.
Puritan	S.	White Beauty of Hebron.
Purple Champion	I.	Champion.
Queen Mary	S.	Royal Kidney.
Queen Mauve (also see Mauve Queen)	S.	Green Champion.
Queen of the Earlies	S.	Duke of York.
Queen of the Veldt	S.	D.
Raeburn's Gregor Cup	I.	D.
Rafters	S.	D.
Raheen Pride	—	D.
Ranfurly Red	I.	D.
Reading Russet	S.	D.
Rector	I.	D.
Red Apple	—	D.
Red Cross	I.	D.
Red Cups	I.	Cups.
Red Flounder	I.	Red Potato.
Red Kidney	—	D.
Red King	S.	Selection King Edward
Red Nosed Kidney	—	
Red Potato	I.	D.
Red Rocks	I.	D.
Red Skin	I.	D.
Red White	—	D.
Rehedee	S.	Black Skerry.
Renown	I.	Abundance.
Resistant Snowdrop	I.	Snowdrop.
Rhoderick Dhu	I.	D.
Rocks (White, Brown and Red) ...	I.	D.
Royalty	S.	British Queen.
Rogue Like Cardinal	—	D.
Rogue Like May Queen	S.	D.
Royal Kidney	S.	D.
Ruby Queen	S.	D.
Russet Rural	S.	Russet Rural •New Yorker.
Rural New Yorker	S.	D.
Sackfiller	S.	D.
St. Malo	I.	D.
Schoolmaster	I.	D.
Schoolmaster	I.	Purple Champion.
Scottish Chief	I.	D.
Scottish Farmer	S.	President.
Scottish Triumph	S.	Up-to Date.
Seery's Surprise	S.	Beauty of Hebron.
Sefton Wonder	I.	Russet Great Scot.
Sensation	S.	Up-to Date.
Shamrock	I.	D.
Shaun Power	I.	Earl of Essex.
Sharpe's Express	S.	D.
Sharpe's Victor	S.	D.
Sharpe's Pink Seedling	I.	D.
Silver Shamrock	I.	Champion II.

Name.	Immune (I) or Susceptible (S.)	(D.) Distinct Variety or Synonymous with.
Silver Skins	I.	White Rocks.
Sim Grey	S.	Lymm Grey.
Sir John Llewelyn	S.	Eclipse.
Skerry	S.	Black Skerry.
Skerry Blue	I.	D.
Skerry Champion	I.	Buchan Beauty.
Snowdrop	I.	D.
Snowflake	I.	D.
Southern Champion	I.	King George V.
Southesk	I.	D.
Southampton Wonder	I.	Great Scot.
Spry's Abundance	S.	D.
Stirling Castle	S.	D.
Stouter	I.	Bloomers.
Striped Champion	I.	Buchan Beauty.
Success	S.	Arran Chief.
Summit	S.	D.
Sutton's Abundance	I.	Abundance.
Templar	I.	D.
The Baron	I.	D.
The Towse	I.	D.
Thomes	I.	D.
Thome Black	I.	D.
Tinwald Perfection	I.	D.
Titan	I.	Crusader.
Toley	S.	D.
Torquil	I.	Catriona.
Tremendous	S.	Up-to-Date.
Tremendous	I.	Great Scot.
Ulster Monarch	I.	D.
Up-to-Date	S.	D.
Utility	I.	D.
Victoria (Paterson)	—	D.
Victory	S.	Duke of York.
Village Blacksmith	S.	D.
Vitality	S.	D.
Vitality	S.	Arran Chief.
Waverley	S.	D.
What's Wanted	I.	Maincrop.
White City	I.	D.
White Pebble	I.	Abundance.
White Rocks	I.	D.
White Stone	S.	British Queen.
Windsor Castle	S.	D.
Witchhill	I.	Snowdrop.
Woodstocks	S.	Up-to-Date.
Yam	S.	D.
Yankee	S.	D.
Yankee Baby	I.	D.
Yellow Potato	I.	Brown Rock.

The foregoing list contains the names of all the principal varieties that are or have been in commerce for the past forty years.

Varieties of Potatoes to which Lord Derby Gold Medals have been awarded as the result of trials conducted at the Potato Testing Station, Ormskirk.

1916.—Kerr's Pink and Lochar.

1917.—Ally.

1918.—No award.

1919.—Arran Comrade

1920.—Rhoderick Dhu.

1921.—No award.

1922.—No award.

1923.—Ben Cruachan.

1924.—No award.

1925.—Arran Consul.

1926.—No award.

1927.—Arran Banner.

1928.—Arran Crest.

1929.—No award.

1930.—No award.

1931.—Arran Pilot.

1932.—Arran Cairn and Doon Pearl.

1933.—No award.

1934.—Arran Signet.

1935.—Gladstone.

1936.—Doon Early, Dunbar Standard and Redskin.

List of varieties of potatoes registered by the Department of Agriculture for Scotland since the inception of the Scheme in 1921, as a result of Trials conducted at East Craigs, near Edinburgh. "The object of these trials is to give a trustworthy indication of Yielding Capacity and Maturity before the variety is placed on the market. Each new variety is compared with a standard variety in its same class". A variety is tested for three successive years. Varieties immune from Wart Disease only are tested.

Year of Registration.	Name of Variety.	Raiser or Introducer.
1925	Arran Consul	Donald Mackelvie
1926	—	—
1927	Arran Banner	Donald Mackelvie
do.	Herald	McGill and Smith
1928	Arran Crest	Donald Mackelvie
1929	—	—
1930	Arran Pilot	Donald Mackelvie
1931	—	—
1932	—	—
1933	—	—
1934	Doon Early	McGill and Smith
do.	Gladstone	McGill and Smith
do.	Alness	Scottish Society for Research in Plant Breeding
do.	Redskin	William Pollock
1935	Arran Peak	Donald Mackelvie
1936	Dunbar Rover	Charles T. Spence
do.	Dunbar Standard	Charles T. Spence

ABUNDANCE.

Tuber.—Thick, oval, sometimes almost round, slightly flattened; *eyes* shallow, *eyebrow* very pronounced and long, *skin* white, *flesh* white. *Underground runners* show purple colour where they adjoin tubers.

Sprout.—Purple.

Foliage.—*Haulm* tall, upright, very vigorous; slight bronzing on *stems*, particularly at leaf axil, some sulphury colour on young foliage, *wing* broad and straight; *leaf* **close and crowded,** due to short internodes and well developed secondaries, **arched,** no colour in *midrib; leaflets* large dark green, not quite as glossy as British Queen, *terminal* drooping; *secondaries* well developed, rounded.

Flower.—White, large, numerous, *anthers* yellow, well developed, *style* **always protrudes about $\frac{1}{8}$ inch above the top of the anthers;** *buds* not as deeply coloured as British Queen; *flower cluster stalk* long, rising near top of stem and carrying flowers high above foliage; *flower stalks* not as long as in British Queen, buds, in consequence, are not drooping to the same extent. An occasional *berry* produced.

Maturity.—Early Maincrop.

Disease Resistance.—Immune from Wart Disease. Now rather subject to Blight, but was considered resistant when introduced. Stocks wonderfully free from virus, but when affected with Leaf Roll, effects are very severe. Virus D. causes Top Necrosis.

General Notes.—Raised by the late James Clarke, Denmark Place, Christchurch, Hampshire, who died 1890. Introduced by Messrs. Sutton & Sons, Reading, in 1886. *Yield* good, *quality* very good, *keeps* fairly well. A popular variety extensively grown at one time in Great Britain and Ireland, but now rare. Synonyms of this variety to the number of at least one hundred have been put on the market, see list, a tribute to the popularity of the variety. No variety except Up-to-Date and British Queen has had so many synonyms.

ACHIEVEMENT.

Tuber.—Oval, flattened, *eyes* medium to shallow, eyebrow pronounced, *skin* white, *flesh* white.

Sprout.—Faint pink at base, colourless at tips.

Foliage.—*Haulm* semi-erect, medium height; *stem* develops some reddish purple, mottling, *wing* straight, *leaf* **long, open,**

midrib slightly coloured at base and at base of leaflet stalks, *leaflets* fairly large, pointed, *leaflet stalks* long, medium green, *secondaries* fairly well developed, pointed.

Flower.—White, rare, small; *buds* fairly numerous, **small,** dark red, purple, hairs drop readily; *flower cluster stalk* short and thin, *flower stalks* fairly short carrying buds horizontal or drooping.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Introduced by Isaac Poad & Sons, York, about 1920. *Yield* good, but tubers very numerous and rather small, *quality* fair, keeps well. Of no commercial importance at any time.

ADIRONDACK.

Tuber.—Round, *eyes* deep, *eyebrow* present; *skin* deep pink, with deeper colour in eyes, *flesh* white, firm.

Sprout.—Deep pink.

Foliage.—*Haulm* medium height, semi-erect; *stem* develops some colour, particularly at nodes, *wing* crinkled; *leaf* open, rigid, *midrib* **markedly red-purple at base and at the bases of leaflet stalks;** *leaflets* medium green, glossy, slightly crinkled.

Flower.—Red-purple, white tips, streaked red-purple, *anthers* pale, malformed; *buds* green at base, remainder red-purple; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Second early.

Disease Resistance.—Immune frm Wart Disease.

General Notes.—Origin not definitely known. Probably introduced by Messrs. B. K. Bliss & Sons, 1881. Awarded a First Class Certificate by the Horticultural Society in 1881. Grown only as an exhibition variety, now almost extinct.

ALANNAH.

Tuber.—Round to oval, irregular; *eyes* medium to shallow; *eyebrows* distinct; *skin* white; *flesh* white.

Sprouts.—Pink.

Foliage.—*Haulm* spreading, medium height, remarkably vigorous, more open than British Queen, which it closely

resembles in some respects; *stems* thick and strong, small amount of colour on *stem*, *wing* slightly waved, not nearly as much so as British Queen, often straight; *leaf* fairly open, no colour in *midrib; leaflet* dark green, large, glossy, scarcely as glossy as British Queen, slight crinkling noticeable; *leaflet stalks* fairly long; *secondaries* fairly well developed.

Flower.—White, large, numerous, slightly larger than British Queen; *anthers* much deeper yellow than British Queen, larger and better formed; *buds* dark reddish purple, identical with British Queen, *berries* numerous; *flower cluster stalk* long, unlike British Queen it rises from leaf axil near top of plant, and so carries flowers high above foliage, *flower stalks* long, buds drooping.

Maturity.—Early maincrop, decidedly later than British Queen.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised and introduced by Sir Josslyn Gore-Booth, Bart., Lissadell, Sligo, in 1928. *Yield* good, *quality* poor, *keeps* well. Very vigorous.

ALLY.

Tuber.—Flattened, oval to oblong; *eyes* shallow, *eyebrow* indistinct, *skin* somewhat yellow, *flesh* white.

Sprout.—Very faint pink at base.

Foliage.—*Haulm* spreading, medium height; *stem* develops practically no purple colouring: *leaf* fairly close due to short internodes, *midrib* shows no colouring; *leaflets* large, **dark grey-green, very hairy,** pointed, *secondaries* not numerous, small, rounded.

Flower.—White, not numerous, seldom more than one flower produced in *cluster; anthers* **very pale and malformed,** *buds* green, purple markings not numerous; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Late second early.

Disease Resistance.—Immune to Wart Disease. Fairly resistant to Blight. Leaf Roll effects not severe, similar to Up-to-date.

General Notes.—*Yield* good, *quality* poor, *keeps* well. Raised by D. Mackelvie, Arran, in 1907, and put on the market as Arran Treasure. Withdrawn on account of its poor quality and later put on the market in 1915 by Messrs. Poad. Grown to some extent in Lincolnshire, but not very extensively elsewhere. Never grown commercially in Ireland. *Bolters* occur. Awarded Lord Derby Gold Medal in Ormskirk Trials, 1917. The variety Allies is identical with Northern Star.

ALNESS.

Tuber.—Round to oval; *eyes* shallow; *skin* white; *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* medium height, spreading; *stem* green, very little purple colouring developed; *wing* slightly waved; *leaf* stiff, erect; *leaflets* broad, yellowish-green, terminal not overlapped; *secondary leaflets* small.

Flower.—White, fairly numerous; *anthers* orange; *buds* dark purple; *flower cluster stalk* strong; *berries* occur.

Maturity.—Second Early.

Disease Resistance.—Immune from Wart Disease. Virus disease rather prevalent in stocks.

General Notes.—Raised and introduced by the Scottish Society for Research in Plant Breeding in 1934. Registered by the Scottish Department of Agriculture in 1934. Does not promise to be a commercial success.

AMERICA.

Tuber.—Round, slightly flattened, dented at *heel; eyes* fairly deep, *eyebrow* fairly distinct and long; *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* semi-erect, medium height; *stems* strong, a little colour on stems; *leaf* arched, fairly close, due to short internodes; *midrib* shows trace of colour at base and in axils of leaflet stalks; *leaflets* **large,** glossy, rounded, medium green, and ridged between veins; *secondary leaflets* fairly well developed, not numerous.

Flower.—Light reddish-purple, tipped white, fairly numerous, *petals* large, *anthers* well formed, deep yellow; *buds* reddish purple, green tips, *buds* show distinct **pink** on back of *petals* exposed between *sepals* before opening; *flower cluster stalk* very long, mostly arising low down on stem; *flower stalk* long, deeply coloured, with buds drooping.

Maturity.—First early.

Disease Resistance.—Imumne from Wart Disease. Very subject to Blight. Subject to Black Leg. Very subject to Dry Rot.

General Notes.—This is the very extensively grown Irish Cobbler, an American potato. *Keeping quality* poor. Failure in Great Britain and Ireland.

ARRAN BANNER.

Tuber.—Round, flattened; *eyes* medium to shallow, deeper at rose end, *eyebrow* distinct; *skin* white, *flesh* white.

Sprout.—Pink, not as deep pink as Great Scot; strong.

Foliage.—*Haulm* tall, vigorous, semi-erect, later becoming prone; *stem* thick, slight bronzing, particularly at the *nodes; wing* generally crinkled at the tip; *leaf* open, large, trace of colour in *midrib; upper leaves* show a distinct light green colour; *leaflets* inclined to be round, fairly large, **slight crinkling, very characteristic dark grey-green;** *secondary leaflets* well developed and numerous, being borne on midrib and on leaflet stalks; a very characteristic pair of large *secondaries* invariably occur on the stalks of the first pair of primaries.

Flower.—White, small, rare, *anthers* very malformed; *buds* fairly large, dark purple green base and tips, slightly more coloured than the buds of Great Scot, hairy, hairs upstanding; *flower cluster stalk* short, *flower stalk* short, carrying buds horizontal.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight. Stocks easily kept free from Leaf Roll. "Carrier" of Virus B. Resistant to Common Scab. Rather subject to Skin Spot.

General Notes.—Raised and introduced by D. Mackelvie, Lamlash, Arran, in 1926-27, and sold at £50 per stone. Parentage Abundance crossed with Flourball. It proved a good investment to several growers at this price. Its price in 1927-28 was £8 per stone and in 1928-29 £40 per ton, or £4 per cwt. In 1929-30 the price was £3 to £5 per ton owing to general slump in prices due to the heaviest average yield on record in nearly all potato-growing countries. *Yield* extra heavy, the heaviest cropper in cultivation, *quality* medium to good, *keeps* well. Awarded a

	Arran Banner.	Arran Chief.	Great Scot.
Maturity ...	Early Maincrop.	Fully two weeks later than Banner or Scot.	Probably a week earler than Banner.
Upper Leaves	Drooping.	Stiff and ersct.	Drooping.
Wing ...	Mostly straight, some crinkling at top.	Crinkled.	Straight.
Leaf ...	Secondaries large, frequently occurring on leafit stalks.	Secondaries not numerous, fairly large.	Secondaries not so well developed, though fairly large.
Leaflet ...	Dark grey-green.	Dark green.	Dark green.
Flower Buds	Pink. More hairy and hairs more erect than in the case of Great Scot.	Almost green.	Pink.

Lord Derby Gold medal at Ormskirk, 1927. In 1936 Arran Banner was second only to Kerr's Pink in popularity in the Irish Free State, and with 25,066 acres in Great Britain was exceeded only by Majestic, King Edward and Eclipse.

ARRAN CAIRN.

Tuber.—Oval tending to long; *eyes* very shallow; *skin* white: *flesh* pale lemon, almost white.

Sprout.—Pink.

Foliage.—*Haulm* upright, vigorous, strong, *stem* tall, branching, purple mottling: *wing* slightly waved; *leaf* decidedly long, open, *midrib of young leaves* shows decided colour at base of, and on *leaflet stalks; young growth* sulphury; *leaflets* fairly large, pointed, slightly crinkled, in early stages bear resemblance to Arran Banner; end pair seldom overlap terminal, extra long portion of midrib of leaf adjoining stem bare of leaflets; *secondaries* small, not numerous, secondary leaflets practically never occur between terminal and first pair of primaries, generally present in Up-to-Date.

Flower.—Red purple, slightly darker in shade than Up-to-Date, distinctly white-tipped, fairly numerous, large, not carried so high above foliage as in the case of Up-to-Date, does not bloom so profusely as Up-to-Date; *anthers* orange, regular; *buds* dark red-purple; *flower cluster stalk*, bronzed, not so thick as Up-to-Date, medium length; *flower stalks* medium length.

Maturity.—Maincrop, a little on the late side.

Disease Resistance.—Immune from Wart Disease. Foliage fairly resistant to Blight, but tubers possess no special resistance; appeared to be subject to Leaf Roll and effects severe; apparently tolerant of the Mosaic Diseases.

General Notes.—Raised and introduced by Donald Mackelvie, Lamlash, Arran, in 1933. Awarded Lord Derby Gold Medal in Ormskirk Trials, 1932. Parentage May Queen crossed with Pepo. Came from same seed apple as Arran Pilot. Produced very satisfactory crops in 1935 but was badly blighted in 1936.

ARRAN CHIEF.

Tuber.—Round, slightly flattened; *eyes* medium generally on end of tuber, not on shoulder (see Great Scot): *skin* white, sometimes purple spot at *heel; flesh* white.

Sprout.—Purple, rather weak, practically free from *hairs* (see Arran Comrade).

Foliage.—*Haulm* erect, fairly tall, vigorous, except in very young stage; purple mottling on *stem*, *wing* **crinkled;** *leaf* open, **fairly rigid, particularly on young growth near top of plant,** no colour in *midrib; leaflets* dark green, large, glossy, *terminal* drooping but not to the same extent as in Great Scot; *secondaries* not numerous, fairly large.

Flower.—White, rare, small; *anthers* pale yellow, practically always malformed; *buds* **mostly green, with some purple markings, but never as deeply coloured as Great Scot,** more hairy than Great Scot buds; *flower cluster stalk* short, but longer than Great Scot, *flower stalks* short.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease. Better than average resistance to Blight. Leaf Roll if present, effects very severe. Not tolerant of most of the virus diseases, though Virus Y causes only a mild mosaic mottling. Virus B, however, produces Top Necrosis and Virus D causes Foliar Necrosis.

General Notes.—Raiser and introducer, Donald Mackelvie, Arran. Parentage not known. Put on the market in 1911. The first variety put on the market by this famous raiser. *Yield* very good, *quality* excellent, *keeps* well. Very popular in Ireland between 1914 and 1926. Never very popular in England on account of its shape. *Berries* have been found, but extremely rare. On account of its susceptibility to Wart Disease was replaced by Kerr's Pink, Arran Banner and other varieties.

ARRAN COMRADE.

Tuber.—Flattened round, remarkably uniform, the most perfect round variety in cultivation; *eyes* very shallow, *eyebrow* present, *skin* white, *flesh* white. An excellent show tuber.

Sprout.—Purple, fairly strong, and **covered with short** *hairs* (see Arran Chief).

Foliage.—*Haulm* medium height, spreading, characteristic drooping appearance; *stems* show little colour; *leaf* fairly open and drooping; *midrib* slight colour in two lines at base of leaflet stalks; *leaflet* fairly large, pointed, not as dark green or glossy as British Queen; *secondaries* fairly well developed.

Flower.—White, fairly numerous, *buds* green at base and tips, remainder reddish purple, not nearly as dark in colour as British Queen, hairy; *flower cluster stalk* long, generally arising from top of stem, thus carrying flower well above foliage; *flower stalks* shorter than in British Queen, in consequence flower buds do

not droop to the same extent; *buds* appear in early stages in tight clusters at top of plant, showing white ends.

Maturity.—Second early, a week earlier than British Queen.

Disease Resistance.—Immune from Wart Disease. Rather susceptible to Blight.

General Notes.—Raised and introduced by D. Mackelvie, Arran, in 1918. *Parentage* unknown. *Yield* medium, *quality* good, *keeps* well. An excellent exhibition variety, but yield was too light, and variety rather too subject to Blight to be a commercial success. Of some commercial importance for a few years, but now practically gone off market, except as an exhibition variety. Awarded Lord Derby Gold Medal in Ormskirk Trials, 1919. A russet-skinned sport was named Arrust Drop.

ARRAN CONSUL.

Tuber.—Oval, sometimes tapering to rose end, flattened, irregular; *eyes* medium, *eyebrow* pronounced; *skin* white, *flesh* very pale lemon, practically white.

Sprout.—Light pink at base, white tips.

Foliage.—*Haulm* upright; *stem* strong and somewhat bare, very little colour on stem; *wings* straight; *leaf* **markedly open,** due to abnormal length of leaflet stalks, fairly large, no colour in *midrib; leaflets* fairly large, pointed, hairy, light grey-green, soft, dull, *secondaries* well developed, often borne on leaflet stalks.

Flower.—White, rare, *buds* very dark reddish purple, very hairy, numerous, small, drop readily; *anthers*, yellow; *flower cluster stalk* short, *flower stalk* very short.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. More than average resistance to Blight. Leaf Roll effects very severe, and appears susceptible to this disease. Average tolerance of virus diseases, but Virus Y causes Leaf Drop Streak. A " carrier " of Virus B. Subject to Black Leg. Resistant to Skin Spot.

General Notes.—Raised and introduced by D. Mackelvie, Arran, in 1924. *Parentage* President X Flourball. Sold at £25 per stone. *Yield* good, *quality* fair, *keeps* very well. Awarded Lord Derby Gold Medal in Ormskirk Trials, 1925, and was the first variety to be registered by the Scottish Registration Committee in 1925.

ARRAN CREST.

Tuber.—Round, somewhat flattened; *eyes* medium to deep, *eyebrows* distinct; *skin* white; *flesh* white, soft.

Sprout.—Deep pink.

Foliage.—*Haulm* low, spreading, moderately vigorous; *stem* does not show much red purple colouration except at base; *wings* straight; *leaf* **markedly open, very long,** drooping, not much colour in *midrib; leaflet* medium to dark green, **long** and **pointed,** *leaflet stalks* long, *secondaries* not numerous, fairly well developed, pointed. Usually two pairs well developed secondaries, rising from base of first or second pair of primaries.

Flower.—White, extremely rare; *buds* very small, drop very readily, purple base, small green tips, *hairs* short upstanding; *flower cluster stalk* short, slightly coloured; *flower stalks* very short, coloured, carrying buds erect or horizontal.

Maturity.—First early, from 7 to 10 days earlier than Epicure.

Disease Resistance.—Immune from Wart Disease. Rather subject to Blight. More subject than any other variety to Common Scab. Leaf Roll rarely seen, but very intolerant of all the other viruses except Virus Y. Virus X causes Top Necrosis.

General Notes.—Raised and introduced by Donald Mackelvie, 1928-9, and sold at £60 per cwt. *Parentage*, Epicure crossed with Flourball. *Yield* good, moderate number of large tubers, *quality* poor, *keeps* only moderately well. Awarded a Lord Derby Gold Medal at Ormskirk, 1928. Earliness is its principal if not its only virtue.

ARRAN PEAK.

Tubers.—Thick oval, *eyes* medium to shallow; *skin* thick, yellow, netted sometimes shows slight tinge of colour at heel; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* medium height, strong, upright; *stem* strong, mottled red-purple, a fair amount of colour, branching, *wing* broad and slightly waved; *leaf* young growth very sulphury, open and graceful, *midrib* tinged with colour most pronounced at base of leaflet stalks; *leaflets* **dark green,** dull, fairly large, leaflet stalks long, often bearing secondaries; secondary leaflets very numerous, well developed, often borne on leaflet stalks, pointed.

Flower.—White, numerous; *petals* very large, backs of petals

sometimes tinged purple; *anthers* orange, regular; *buds* large, considerable amount of colour; *flower cluster stalk* long, hairy, strong; *flower stalk* long, buds drooping.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Remarks.—Raised and introduced in 1936-37 by Donald Mackelvie, Lamlash, Arran, who considered Arran Peak the best of the Arran varieties. Price £10 per cwt. in one-ton lots. *Parentage* A. 592 crossed with Herald. The seedling A. 592 came from the same seed apple as Arran Pilot and was a cross between May Queen and Pepo. *Yield* good, *quality* fair, *keeps* well.

ARRAN PILOT.

Tuber.—Kidney, see Figure 78; *eyes* shallow and mostly on point of tuber; *eyebrow* indistinct; *skin* white, *flesh* very pale lemon, practically white.

Sprout.—Purple.

Foliage.—*Haulm* medium height, semi-erect, but straggling when reaching maturity; *stems* fairly numerous, tinged purple especially at base; *wing* broad and straight; *leaf* open, rigid, short, *midrib* tinged purple at base and at base of *leaflet stalks*; *leaflets* dark green, broad, lateral leaflets overlap terminal; *secondaries* small and inconspicuous.

Flower.—Blue-purple, tipped white, infrequent; *anthers* orange; *style* long, buds dark purple; *flower cluster stalk* short, *flower stalks* short.

Maturity.—First Early.

Disease Resistance.—Immune from Wart Disease. About equal to other earlies in its resistance to Blight. Leaf Roll not observed, **but is very intolerant of most of the virus diseases, and requires much more than ordinary care to keep stocks vigorous and healthy.** The leaflets develop a characteristic "blister" which on account of its lighter green colour looks remarkably like Crinkle. This effect is, however, not due to disease, as it is not transmissible. The size of the leaflets is not reduced. In some seasons this "blistering" is more evident than in others, and it usually is more marked late in the season. The progeny of an occasional plant which may be free from "blistering" will usually develop the "blister" in the following season. Apart from the fact that it looks bad on the foliage, it has apparently no injurious effect on the plant. Decidedly more resistant than average to Common Scab.

General Notes.—Registered by the Scottish Registration Committee, December, 1930. *Parentage*, May Queen x Pepo. Raised and introduced by Donald Mackelvie, New Lanark, Lamlash, Arran, in season 1930-31, at £60 per cwt. Awarded a Lord Derby Gold Medal in Ormskirk Trials, 1931. Acreage in Great Britain increased from 849 acres in 1934 to 4,181 acres in 1936.

ARRAN ROSE.

Tuber.—Oval, elongated; *eyes* very shallow, mostly on point of tuber, *eyebrows* present; *skin* **pink, with colour more pronounced in eyes;** *flesh* white.

Sprout.—Bright pink, pink tip, not vigorous.

Foliage.—*Haulm* semi-erect, medium; *stem* tinged pink developing towards maturity, *wing* waved; *leaf* fairly close, trace of colour in *midrib* of young leaves with colour very pronounced on *leaflet stalks*, colour practically disappears later; *leaflet* dark green, crinkled, medium size, pointed; *secondary leaflets* small, not numerous. *Young leaves* on top of plant characteristic appearance, close, erect, *leaflets* cupped.

Flower.—White, rare; *anthers* yellow, regular; *buds* drop readily, purple base, green tips; *flower cluster stalk* very short; *flower stalks* short, purple.

Maturity.—First Early.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised in 1912 and introduced by Donald Mackelvie, Lamlash, Arran, in 1918. *Parentage* unknown. *Yield* poor, *quality* medium, does not keep well. Never grown to any extent, and now off the market (1937).

ARRAN SCOUT.

Tuber.—Flattened, oval, regular; *eyes* shallow; *skin* white; *flesh* white.

Sprout.—Purple, strong.

Foliage.—*Haulm* spreading, vigorous; *stem* little colouring, thick, strong; *wing* straight; *leaf* open due to long *leaflet stalks;* no colouring except in *leaf axil; leaflets* **very large,** dark green; *secondary leaflets* well developed, fairly numerous, sometimes on *leaflet stalk*.

Flower.—None observed; *buds* not numerous, small, **very dark purple,** hairy; *flower cluster stalk* short, slightly coloured; *flower stalk* short.

Maturity.—First early.

Disease Resistance.—Immune from Wart Disease; subject to Blight.

General Notes.—Raised and introduced by Donald Mackelvie, Lamlash, Arran, in season 1930-31. *Yield* very good, *quality* fair, *keeps badly*. This variety was thrown into the shade by Arran Pilot. It has, however, many good points, but kept very badly in this country.

ARRAN SIGNET.

Tuber.—Thick kidney, **one of the most perfect shaped kidney tubers;** *eyes* very shallow; *skin* white often shows purple shade in patches, distinct purple splashes when grown on bog land; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* low, compact, fairly strong, *stem* thick, not much colour but some develops towards maturity; *wing* straight; *leaf* long, open, *midrib* plainly shows some colour in young leaves; *leaflet* long, flat, **pointed, large,** glossy, light green, soft appearance, colour on *leaflet stalk* most pronounced at base; *secondary leaflets* few and inconspicuous.

Flower.—White, fairly numerous, sepals large, buds deep purple; *anthers* orange, regular; *flower cluster stalk* green, fairly long, comes off low down, and in consequence flower does not show much above foliage; *flower stalk* fairly long, purple, buds dropping.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised and introduced by Donald Mackelvie, Lamlash, Arran, in 1936. Awarded a Lord Derby Gold Medal in the Ormskirk Trials, 1934. *Parentage* Seedling A.592 crossed with Seedling B.858, the latter a cross between Majestic and Seedling 246/42. *Yield* fairly good, *quality* fair, *yield* variable sometimes very good. This variety is strongly recommended for exhibition purposes.

ARRAN VICTORY.

Tuber.—Round to oval; somewhat irregular; *eyes* fairly deep, *eyebrow* distinct; *skin* deep purple; *flesh* white.

Sprout.—Deep purple, sprouts early.

Foliage.—*Haulm* upright, fairly tall; colour on *stem* plentiful, developing towards maturity; *leaf* open, plenty of colour in *midrib;* between terminal and first pair of primaries, a pair of

secondaries if present at all are **very small** (see Kerr's Pink); *leaflets* medium to dark green, pointed: *terminal* **drooping;** *secondaries* fairly numerous, often borne on leaflet stalks, fairly well developed.

Flower.—White, not numerous, *anthers* pale yellow, malformed; *sepals* long; *buds* purple, very hairy, *hairs* adpressed, numerous; *flower cluster* stalk short and thin; *flower stalks* very short, carrying flower buds erect or horizontal.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Foliage moderately resistant to Blight, tubers very resistant to Blight: Leaf Roll effects severe. Intolerant of some of the virus diseases though Virus X produces only a faint mottle, and Virus Y also causes only a mild mosaic mottling. On the other hand Virus B causes Top Necrosis and Virus D produces Foliar Necrosis.

General Notes.—Raised by D. Mackelvie, Arran, and put on the market in 1918. *Parentage* not known. *Yield* good, *quality* good, *keeps* well. Not extensively grown in England or Scotland, very extensively grown in Ireland, particularly in some of the northern counties. A sport having tubers almost white-skinned has occurred. A pink-skinned "sport" has also appeared. Frequently mixed with Black Skerry and Peerless after the variety was introduced. Now grown very pure and free from mixtures. The principal points of distinction between the three varieties are shown below.

	Arran Victory.	Peerless.	Black Skerry.
Tuber ...	Generally broader at rose end.	Round.	Broader at heel end.
Leaf ...	Terminal drooping.	Drooping.	Rigid.
Leaflet ...	Pointed.	Rounded.	Small, pointed.
Flower ...	White **not** numerous.	White, **very** numerous.	Light blue-purple, fairly numerous.
Anthers ...	**Pale yellow, malformed.**	**Orange, well-formed.**	Yellow, regular.
Flower Buds	**Purple, hairs adpressed.**	**Dark greenish purple, hairs upstanding.**	—
Haulm ...	Upright.	Upright.	Tall, Stiff and erect.

BALLYDOON.

Tuber.—Oval, flattened; *eyes* medium to shallow; *skin* white; *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* vigorous, more spreading than British Queen, especially in later stages, medium height; *stem* bronzed, scarcely as much so as British Queen, seldom branching; *wing* almost straight, Queen shows more waving; *leaf* rigid, fairly open much the same as British Queen, *midrib* shows no colouring, shorter and has fewer leaflets than British Queen: *leaflets* dark green, large, glossy, end pair slightly overlap terminal, an occasional terminal tied; *secondary leaflets* fairly numerous, moderately well developed.

Flower.—White, large, fairly numerous; *style* longer than in British Queen; decided pink blush on back of *petals; anthers* yellow, well formed; *buds* hairy, dark purple, but if anything not as much coloured as British Queen; *flower cluster stalk* not so strong or so deeply bronzed as British Queen, it is almost green, carries flower well above foliage.

Maturity.—Second early, almost a first early.

Disease Resistance.—Immune from Wart Disease. Tolerant of most of the virus diseases. Very susceptible to Blight—its only really serious fault.

General Notes.—Raised and introduced by McGill and Smith, Ayr, in 1931. *Yield* good, *quality* good. Grown to a considerable extent in some of the Northern Counties as an immune substitue for British Queen.

BARLEY BOUNTY.

Tuber.—Long oval, *eyes* shallow, *skin* white, *flesh* white.

Sprouts.—Faint pink.

Foliage.—Semi-erect, medium height; *stems* numerous, tinged red-purple, especially at base, *wings* crinkled; *leaf* open, drooping, no colour in *midrib; leaflets* light green, dull, hairy, crinkled (probably due to Mosaic, though mottling is absent); *secondaries* large, numerous.

Flower.—Red-purple, white tips, small, numerous; buds red-purple.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised 1911 and introduced by Dr. R. N. Salaman, 1922. Yield too light to be a commercial success.

BEAUTIES.

Tuber.—Round, rough; *eyes* deep, numerous; *eyebrow* prominent; *skin*, yellow; *flesh*, pale yellow.

Sprout.—Light pink.

Foliage.—*Haulm* spreading; *stems* numerous, branching, no colour developed; *wing* crinkled; *leaf* open, considerable amount of sulphury growth on top, no colour in *midrib; leaflets* **light green, small;** *secondaries* small, sometimes borne on leaflet stalks.

Flower.—Light reddish purple, tipped white, very large and distinct, only an occasional flower formed, bloomed freely in 1934, and each cluster had up to 6 flowers; *buds* green base and green tips, band of purple round centre, fairly numerous, drop readily; *flower cluster stalk* fairly short and green; *flower stalks* medium.

Maturity.—Maincrop.

Disease Resistance..—Susceptible to Wart Disease.

General Notes.—An old variety. Origin unknown. Of no commercial value.

BEAUTY OF BUTE.

Tuber.—Flattened round to oblong, deep dent at *heel; eyes* fairly deep; *eyebrow* often raised; *skin* white with pink dots, and frequently pink in *eyes* and sometimes around eyes; tubers having decidedly pink eyes and tubers having no colour in eyes can be got from the same plant; *flesh* tinged lemon.

Sprout.—Deep pink.

Foliage.—*Haulm* a bit straggly, fairly tall; *stem* branching, near top of plant stem frequently shows zig-zag appearance, **very little colour in** *stem*, *stems* appear a bit bare; *wings* **broad,** slightly waved; *leaf* open, arched, *centre of midrib* shows no colour, but is raised showing distinctly two parallel lines along midrib; *young leaves* rigid, *older leaves* drooping; *young growth* sulphury; *leaflets* very hairy, **greyish green;** *secondaries* fairly numerous, small pointed. A prominent pair of secondaries generally occur on the midrib about half way between the first and second pair of primaries. (See John Bull).

Flower.—Deep reddish purple rather large white tips; fairly numerous; *anthers* yellow, well-formed; *buds* green with dark reddish purple markings; *flower cluster stalk* fairly short and thin; *flower stalks* short, coloured. *Berries* sometimes produced.

Maturity.—Main crop.

Disease Resistance.—Immune from Wart Disease. Rather subject to Blight.

General Notes.—*Yield* fair, produces a very large number of medium to small tubers, hence persistence as a " rogue "; *quality* fair, *keeps* fairly well. This variety occurs frequently as a " rogue " in many varieties, notably Up-to-Date and Epicure. Raised by James Heron, Rothsea, Buteshire, about 1890. Grown to some extent in Ireland, but now unknown except as a rogue, save in isolated areas, notably Sligo, and parts of Wexford. This variety in many respects closely resembles " John Bull."

BEAUTY OF HEBRON.

Tuber.—Oval to long, frequently tapering towards rose end; *eyes* moderately deep; *eyebrows* very distinct and long; *skin* light pink, portion white, particularly about the eyes; *flesh* very white, soft and brittle.

Sprout.—Deep pink.

Foliage.—*Haulm* spreading, medium height; colour not pronounced on *stem* except at leaf axil, **not so much colour as on Early Rose;** *leaf* long, open; *internodes* long, colour in *midrib* not pronounced except at base and at base of leaflet stalks; *leaflets* fairly large; *leaflet stalks* long, rather pale green *colour*, lighter than British Queen.

Flower.—White fairly numerous. See Early Rose.

Maturity.—First early.

Disease Resistance.—Susceptible to Wart Disease. Subject to Blight. Leaf Roll rarely seen; tolerant of the virus diseases.

General Notes.—This variety is identical with Early Rose, except that the latter has more colour on tuber and on foliage. It was at one time a popular garden potato, but has gone out largely on account of bad keeping quality. *Yield* excellent, *quality* fair. An American variety, put on the market by Peter Henderson, New York, 1878. If it is not a sport from Early Rose, it looks like one. It was also known as Red Elephant.

BEN CRUACHAN.

Tuber.—Oval, elongated, flattened; *eyes* shallow, *eyebrow* distinct, *skin* white, *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* erect, very tall, vigorous; *stem* somewhat bare of leaves, considerable amount of colour develops; *leaf* open, *midrib* faint purple with colour pronounced at base and in axils of leaflet stalks, colour also on *leaflet stalks; leaflets* fairly

large, **hairy, giving harsh light grey-green colour,** pointed; *leaflet stalks* long, sometimes bearing well-developed secondaries; *secondaries* numerous, well-developed.

Flower.—White, not numerous; *buds* deep blue purple, numerous, drop readily; *flower cluster stalk* short, *flower stalk short*, deeply coloured.

Maturity.—Late maincrop.

Disease Resistance.—Immune from Wart Disease. Resistant to Blight.

General Notes.—Awarded a Lord Derby Gold Medal at Ormskirk in 1923. *Yield* medium, *quality* fair, *keeps* fairly well. Maturity too late to be a commercial success. Raised by the late Rev. Aikman Paton, Soulseat, Scotland, in 1916. Introduced by Messrs. Sutton & Sons, 1923.

BEN LOMOND.

Tuber.—Oval, rather small; *eyes* shallow, *eyebrow* present, *skin* white, *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* spreading, compact, bushy, vigorous; *stem* develops colour only at base and at nodes; *wings* wide and straight; *leaf* rather close, due to short leaflet stalks, arched, fairly large; *leaflets* **very dark green, large, glossy,** pronounced ridging between veins; *secondaries* conspicuous, rounded.

Flower.—White, not numerous; *buds* numerous, drop readily, not so deeply coloured as British Queen, green base and green tips, purple markings; *flower cluster stalk* short; *flower stalks* short, coloured.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight.

General Notes.—Raised by the late Rev. Aikman Paton, Soulseat, Scotland, about 1916, and introduced by Messrs. Sutton and Sons, 1923. *Yield* good, but tubers generally numerous and small; *quality* fair, *keeps* rather well.

BISHOP.

Tuber.—Kidney, one of the most perfect-shaped varieties for exhibition purposes; *eyes* very shallow and on point of tuber; *eyebrow* indistinct; *skin* white, *flesh* lemon.

Sprout.—Pink.

Foliage.—*Haulm* erect, **tall;** *stems* **a bit bare,** branching, plenty

of colour developed; *wing* generally waved: *leaf fairly* open, very long, faint colour in *midribs* and on *leaflet stalks; leaflet* medium green, slightly crinkled, long; *secondaries* large.

Flower.—Dark red purple—probably shows deeper red than the flower of any commercial variety except Sharpe's Express—tips white, soon fades, numerous; *anthers* yellow, irregular; *buds* dark red purple, *flower cluster stalk* long, carrying flowers well above foliage; *flower stalks* short, giving buds clustered appearance.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight. Leaf Roll not seen. Not tolerant of most of the virus diseases.

General Notes.—Raised by the late Dr. Wilson, St. Andrews, in 1906. Introduced by Mr. J. Roger, Balgrove, St. Andrews, in 1912. *Yield* poor, *quality* fair, *keeps* well. An excellent exhibition variety, but yield is too light to be a commercial success.

BLACK CHAMPION.

Tuber.—Oval to long, irregular; *eyes* medium to deep, and pretty well dotted all over tuber; *eyebrow* indistinct; *skin* white, with purple splashes, sometimes in bands, sometimes rose end all purple, and colour is sometimes nearly absent, *flesh* pale lemon, practically white.

Sprout.—Purple.

Foliage.—*Haulm* erect, tall, vigorous; *stem* shows colour only in leaf axil in young stage, develops to some extent later; *wing* broad and straight; *leaf* close, slightly drooping, *midrib* faintly coloured with distinct purple spots in axils of stalks of leaflets: *leaflet* **thin, glossy, large,** pointed and twisted towards terminal, and overlapping it. *Secondaries* fairly large, not numerous.

Flower.—Dark blue purple, white tipped, fairly numerous; *anthers* orange; *buds* dark blue purple, green tips, *hairs* inconspicuous, *flower cluster stalk* long, *flower stalks* long, deeply coloured, with buds drooping. *Berries* **freely formed.**

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Resistant to Blight. Leaf Roll rare: very intolerant of the virus diseases. foliage becomes unrecognisable.

General Notes.—An old variety, origin unknown, grown in isolated patches in Midlands. Known also as Scotch Greys. Liable to be mistaken for Buchan Beauty in tuber, but flesh is not nearly so yellow. Has no resemblance to Champion. Of no commercial value.

BLACK SKERRY.

Tuber.—Flattened round to oval, generally tapering to rose end, irregular, dented at *heel*, *eyes* fairly deep, *eyebrows* distinct; *skin* deep purple, *flesh* white.

Sprout.—Deep purple.

Foliage. –*Haulm* markedly erect, tall; deep blue purple blotches on *stems*, gradually developing to cover practically the whole stem; *stems* thin, numerous, wiry, inclined to be bare of leaves; *wing* distinctly waved, *wing* near top of plant more crinkled than Peerless; *leaf* markedly rigid, open, large when healthy; *midribs* very dark blue purple, colour carried into midrib of leaflet; *leaflets* long, narrow, pointed, glossy, dark green; *secondaries* **remarkably few,** usually small, sometimes absent.

Flower.—Light bluish purple, comparatively large white tips, small, not numerous, *anthers* yellow, often malformed; *buds* dark purple, small, numerous, hairy; *flower cluster stalk* fairly short; *flower stalks* fairly short.

Maturity.—Late maincrop.

Disease Resistance.—Susceptible to Wart Disease. Very resistant to Blight. Leaf Roll rare, but effects very severe. Tolerant of most of the virus diseases.

General Notes.—Origin unknown, but local tradition in South Derry ascribes it to Burnside, probably about 1900. A variety grown at one time extensively in Co. Tyrone and other areas near Lough Neagh for the Belfast and Dublin markets. *Quality* excellent, particularly noticeable from April to end of June, *yield* light. Now almost entirely replaced by Arran Victory.

BLIGHT RESISTER.

Tuber.—Round to long, very irregular; *eyes* moderate depth; *eyebrows* long and distinct; *skin* peculiar shade of purple tending to violet, much deeper colour in eyes; *flesh* white.

Sprout.—Bright purple.

Foliage.—Haulm erect; colour in *stem* very pronounced; *wing* sometimes crinkled; *leaf* open, rigid, with dark purple colour very pronounced in *midrib* and continued into midrib of leaflet; *leaflet* pointed, medium size, **very dark greyish green;** *terminal* occasionally tied; *leaflet stalks* dark coloured with colour carried well into midrib of leaflet. *Secondaries* small, rounded, not numerous.

Flower.—Appears **light blue**, fairly numerous; *anthers* some-

times pale and often very malformed; *buds* greenish purple, hairy; *flower cluster stalk* long; *flower stalks long*, buds drooping.

Maturity.—Maincrop.

Disease Resistance.—Very susceptible to Wart Disease. Not specially resistant to Blight, despite its name: very intolerant of the virus diseases, and foliage becomes unrecognisable.

General Notes.—*Yield* good, *quality* fair, *keeping properties* medium. Of no commercial value. Found as a "rogue" among stocks of Hibernia (Gardenfiller) in Athlone district. Origin not known.

BLOOMERS.

Tuber.—Round, flattened, shortest axis from rose end to heel, deep dent at heel; *eyes* deep, inclined to be congregated at rose end; *eyebrow* present; *skin* deep purple; *flesh* tinged lemon, slight trace of purple under skin at rose end.

Sprout.—Deep purple.

Foliage.—*Haulm* erect, medium height; *stems* develop large amount of blue purple colour; *leaf* long, fairly close, due to well-developed secondary leaflets, *midrib* deep purple colour, with colour continued on leaflet stalks and partly into midrib of leaflet; *leaflet* medium size, glossy, *terminal* frequently tied; *secondaries* numerous, rounded.

Flower.—**Pale blue,** purple completely obscured, very numerous, large, and large number in *cluster; buds* purple base; **remarkably broad green** *sepals*, *hairs* short; *flower cluster stalks* long and strong, sometimes bearing leaves; *flower stalks* long with buds drooping. Exceptionally large number of berries formed like bunches of grapes.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight, and wonderfully free from Leaf Roll. Some of the virus diseases are usually present, but not readily seen, the variety can certainly be classed as tolerant.

General Notes.—Origin unknown. Very old variety procured from Co. Clare. Wonderfully vigorous. Of no commercial value; grown only in isolated patches. Known also as "Starters" and "Brown Blacks."

BLUE GLOSS.

Tuber.—Round, rough, irregular, dented at *heel; eyes* fairly deep; *eyebrow* distinct and straight; *skin* white, thick; *flesh* **yellow.**

Sprout.—Purple.

Foliage.—*Haulm* medium height, fairly upright; *stems* mottled blue-purple, branching; *wings* broad, slightly waved; *leaf* fairly close, no colouring in *midrib; leaflet* medium green, **glossy, drooping;** *secondaries* small and rounded, young growth sulphury.

Flower.—Blue-purple, tipped white, fairly numerous; *anthers* yellow, *buds* green with purple band and markings; *berries* fairly numerous; *flower cluster stalk* **long and thin;** *flower stalk* medium length, buds drooping.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Origin unknown. Of no commercial value. Found as a "rogue," among King Edward, Langworthy, Evergood, etc. Tubers numerous and small, long underground runners, sometimes showing blue-purple colouring.

BLUE GREY.

Tuber.—Round, *eyes* shallow, saucer-shaped; *eyebrows* distinct; *skin* white; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* medium height, semi-erect; *stems* thin, numerous; *leaf* **open, small, rigid;** *leaflet* grey-green, dull, hairy, wrinkled; *secondary* leaflets very small.

Flower.—Light **blue,** tips white, fairly numerous, *buds* green with purple base; *flower cluster stalk* short; *flower stalk* short.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Origin unknown. Found occasionally as a rogue in stocks of Great Scot, Arran Chief, etc.

BLUE NEBS.

Tuber.—Round to long, irregular, rough; *eyes* moderate depth, *eyebrow* rounded; *skin* purple, with white regions around the eyes and around the heel end; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* upright, tall and strong; numerous purple blotches on *stems; wing* straight; *leaf* fairly large, stiff and erect; *midrib* generally deeply coloured; *leaflets* inclined to be round, fairly large, a bit glossy, medium green, crinkled; *secondaries* small and round, not numerous.

Flower.—Deep blue-purple, very large, very numerous, in large *clusters;* no trace of white *tips; anthers* orange; *buds* green, developing purple markings; *flower cluster stalk* long, carrying flowers high above foliage; *flower stalks* long. *Berries* formed.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease. Leaf Roll not common: intolerant of the virus diseases.

General Notes.—An old variety grown in a few small plots in Co. Antrim mainly for pig feeding.

BOBBIE BURNS.

Tuber.—Round; *eyes* shallow; *eyebrow* indistinct; *skin* white; *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* fairly upright, inclined to become prone; *stem* branching; *wings* broad, slightly waved; *leaf* fairly open, young growth sulphury; *leaflets* medium green, narrow, pointed; *leaflet stalks* long, sometimes bearing secondaries; *secondaries* fairly numerous.

Flower.—Light red-purple; *tips* lighter in colour but not quite white, numerous; *buds* dark reddish purple, very hairy; *flower cluster stalk* long, carrying flowers well above foliage; *flower stalks* fairly long.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease. Fairly resistant to Blight.

General Notes.—Raised by the late W. R. Farish, Dumfries, about 1915. Of no commercial value. Found to a considerable extent in stocks of Lochar when first put on the market. A variety of the same name was sent to Ormskirk for trial in 1917 by Alfred Drummond, Crieff. It was described as a white round second early with white flowers.

BOSTON KIDNEY.

Tuber.—Kidney, a bit irregular; *eyes* shallow; *eyebrow* distinct; *skin* very pale yellow; *flesh* decidedly lemon.

Sprouts.—Faint pink.

Foliage.—*Haulm* semi-erect, medium height; *stem* tinged red purple; *wing* wide, slightly waved; *leaf* decidedly open, trace of colour at base and at base of leaflet stalks; *leaflets* **dark green, glossy,** crinkled, *edges* **markedly waved;** *leaflet stalks* very long, sometimes bearing secondary leaflets; *secondaries* numerous, well-developed.

Flower.—Light reddish purple, tipped white, seldom formed; *buds* green, tinged pink; *flower cluster stalk* very short; *flower stalks* short.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease. Not tolerant of the virus diseases.

General Notes.—*Yield* poor. Not recommended. Not grown in Ireland. Raised by W. Porter, Willoughby House, Boston. Purchased and introduced by J. J. Tunnard, Hubert's Bridge, Boston, Lincs. (Salaman). Raised by F. Waite, Boston, 1912 (Fraser). Frequently known as Dargill Early.

BRAVO.

Tuber.—Round, flattened; *eyes* medium, *skin* white, *flesh* **yellow.** Underground runners show considerable amount of purple colouring.

Sprouts.—Purple.

Foliage.—*Haulm* medium height, spreading; *stems* numerous, thin, wiry, coloured blue-purple at base, *leaf* open, *midrib* shows colour only at base and at base of leaflet stalks; *leaflet* light green, large, dull; *secondaries* small.

Flower.—Light **blue,** tipped white, fairly numerous, buds mostly green, some purple markings; *flower cluster stalk* short; *flower stalk* short.

Maturity.—Early maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Never grown commercially in Ireland.

BRITISH QUEEN.

Tuber.—Oval; *eyes* shallow; *eyebrows* long and distinct; *skin* white, sometimes develops light pink colour on exposure to light, particularly noticeable on those grown in bog land; *flesh* white.

Sprout.—Light pink at base white tip.

Foliage.—*Haulm* **vigorous, spreading,** medium height; *stems* tinged reddish purple, deeply coloured at ground level, branching; *wing* slightly waved; *leaf* fairly open and fairly rigid; *midrib* shows practically no colour; *leaflets* **large, dark green, very glossy,** end pair do not overlap the *terminal*. An occasional *terminal* tied; *secondaries* fairly numerous, not well developed.

Flower.—White, large, numerous; *anthers* yellow, well formed; *stigma* practically level with top of anthers (see Abundance); *buds* hairy, very dark reddish purple at base, always in drooping position due to long flower-stalks; *flower cluster stalk* long, strong, bronze-coloured, comes off low down on stem carrying flower about level with top of foliage.

Maturity.—Second early.

Disease Resistance.—Susceptible to Wart Disease. Now subject to Blight, but reported not to be so when introduced. Leaf Roll effects fairly severe. Crinkle is usually fatal to the plant. Virus Y produces Leaf Drop Streak which also soon proves fatal, and Foliar Necrosis caused by Virus D is almost as bad. Rather subject to Black Leg.

General Notes.—Put on the market by A. Findlay, 1894. *Yield* very good; *quality* excellent; *keeps* well. Probably the best all-round variety that has ever been put on the market. **Bolters** occur.

BUCHAN BEAUTY (Skerry Champion).

Tuber.—Round, irregular; *eyes* deep, *eyebrow* distinct, *skin* yellowish with light blue-purple splashes, frequently in bands round the tuber, the amount of colouring is very variable; *flesh* decidedly yellow, hard, firm.

Sprout.—Purple.

Foliage.—*Haulm* erect, tall, vigorous; *stems* strong, fairly numerous, branching, develop little colour except **at the nodes;** *wing* waved at top; *leaf* **stiff, erect,** fairly open; usually no colour in *midrib*, but frequently a dark spot in axil of leaflet stalk. Deep groove in midrib causes sides to show up as two green lines, sometimes coloured; *leaflet* yellowish green, dull, **crinkled,** medium size; *terminal* frequently tied; *young growth* sulphury; *secondaries* small and rounded, fairly numerous, sometimes on leaflet stalks.

Flower.—Deep blue-purple, **large,** numerous; *tips* almost white; *anthers* yellow, regular; purple band on *style; buds* deep, bluish purple, *flower cluster stalk* long, mottled, blue purple, *flower stalks* long, deeply coloured, sometimes bearing small leaves.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Now very subject to Blight. Intolerant of most of the virus diseases, but not usually affected by Leaf Roll, though if present effects very severe.

General Notes.—Formerly grown to a considerable extent in the Midlands and West of Ireland, where it was ranked as second only to Champion for quality. Known generally as Skerry Champion or Striped Champion. Probably introduced to Ireland as a " rogue " in Champion. Origin unknown.

BUFFS.

Tuber.—Round, dented at *heel* end; *eyes* deep; *eyebrow* not pronounced; *skin* bright purple (violet), with colour decidedly more pronounced in eyes; *flesh* **yellow.**

Sprout.—Deep purple.

Foliage.—*Haulm* upright, medium height; *stem* mottled purple, colour developing towards maturity, branching; *wing* prominent, slightly waved; *leaf* decidedly open, long; *midrib* shows very light purple, except at base of leaf and leaflet stalks, where colour is very distinct; characteristic purple ring round lower surface of base of leaf. *Leaflet* fairly large, long and pointed, medium green, dull, colour pronounced on leaflet stalk and carried a short distance into midrib of leaflet; *secondaries* small, not numerous.

Flower.—Light blue purple, almost blue, fairly numerous; *buds* very dark purple, drooping; *flower cluster stalk* long, slender, and tinged dark purple; greenish *flower stalks* long and deeply coloured. *Berries* occasionally formed.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—An old variety procured in Co. Donegal. Not grown on a commercial scale. The old variety, Buff, mentioned by Lawson was reputed to have a " whitish " flower.

CARDINAL.

Tuber.—Oval to long, regular; *eyes* very shallow; *eyebrow* indistinct; *skin* deep red; *flesh* white with traces of pink.

Sprout.—Deep pink.

Foliage.—*Haulm* medium height, spreading, later becoming prone: *stem* dark red-purple, developing towards maturity; *wing* waved; *leaf* **markedly open;** *midrib* **deep red-purple,** with leaflet stalks deeply coloured and colour carried well into midrib of leaflet and even partly into veins; *leaflets* small, rounded, hairy; *terminal* drooping; *secondaries* numerous, round.

Flower.—Red-purple with white tips, fairly numerous; *anthers* deep yellow, regular; *buds* green, red-purple markings, **green base,** *berries* occur; *flower cluster stalk* fairly long, tinged red purple; *flower stalks* medium length, not much colour.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease. Very intolerant of some of the virus diseases. Very subject to Blight.

General Notes.—Raised by Adam Reid, Williamshaw Farm, Stewarton, Ayrshire. Grown only as an exhibition variety.

CATRIONA,

Tuber.—Oval elongated, very regular; *eyes* very shallow, and on point of tuber; *eyebrow* very slight, *skin* **yellow, with blue-purple colour, very pronounced in eyes and close around eyes,** very rarely splashed as on Di Vernon; *flesh* soft, tinged lemon.

Sprouts.—Purple.

Foliage.—*Haulm* medium height, spreading; *stem* branching freely, some colour developed, increasing towards maturity; *wings* waved; practically no colour in *midrib; leaf* fairly close, drooping, slightly arched, margins generally waved; *leaflets* **dark green;** *terminal* overlapped; *secondaries* numerous, fairly large.

Flower.—Light blue-purple, white tips, fairly numerous; *anthers* yellow, regular; *buds* dark blue purple, very numerous, hairy, drooping; *flower cluster stalk* thin, fairly short, coloured; *flower stalk* fairly short, coloured.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease. Very subject to Dry Rot in certain seasons—one of the worst varieties in this respect.

General Notes.—Raised and introduced by A. Findlay, Auchtermuchty, in 1920. *Yield* good; *quality* excellent; *keeps* badly in general. An excellent variety only that it is a most unreliable keeper.

CATRIONA SUBSTITUTE No. 1.

Tuber.—Round; *eyes* deep; *skin* **white, splashed,** blue-purple; flesh white.

Sprouts.—Purple.

Foliage.—*Haulm* medium height to tall, upright; *stem* mottled blue purple, branching freely; *wings* waved; *leaf* **open** and **rigid;** *midrib* shows colour only at base and at bases of leaflet stalks: *leaflets* medium green, fairly small, broad.

Flower.—Dark blue-purple, small white tips, numerous; *buds* dark purple.

Maturity.—Early maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Seedling mixed with stocks of Catriona.

CATRIONA SUBSTITUTE No. 2,

Tuber.—Round, eyes fairly deep; *skin* white, splashed blue-purple; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* medium height to tall, semi-erect; *stem* light purple, markedly blue-purple at base, *wings* waved; *leaf* **rigid,** *midrib* **shows only faint purple at base and at bases of leaflet stalks;** *leaflets* medium green, glossy, slightly wrinkled, cupped, margins often waved; *secondary leaflets* fairly numerous.

Flower.—None observed.

Maturity.—Early maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—This variety has been sold for Catriona and Di Vernon, and also occurs as a rogue amongst these varieties. Seedling mixed with stocks of Di Vernon and Catriona.

CAVAN LUMPER.

Tuber.—Round to short oval, sometimes tapering to rose end; *eyes* medium, *eyebrow* very pronounced, *skin* white, *flesh* white, occasionally a trace of purple.

Sprout.—Purple.

Foliage.—*Haulm* erect; *stems* **distinctly mottled dark blue purple,** *wing* straight; *leaf* open; *midrib* blue purple continued into leaflet stalks, particularly on young leaves; *leaflets* medium size, light to medium green, pointed; *leaflet stalks* sometimes bearing secondaries; *secondaries* fairly numerous, small.

Flower.—**Light blue,** purple is completely obscured, tips nearly white, **very numerous;** *anthers* deep yellow, well formed; *buds* dark purple, long narrow green *sepals; flower cluster stalk* long and strong, emerges from axil of lower leaves; *flower stalks* long, buds drooping.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease. Tolerant of the virus diseases. Leaf Roll not seen.

General Notes.—This variety was procured in 1923 from Co. Cavan, where it is called Lumper, though it has no resemblance to the genuine Lumper. It has since been procured from two other sources, and is easily recognisable by its striking bloom. Of no commercial value. Origin unknown.

CHAMPION.

Tuber.—Round, somewhat flattened, deep dent at *heel; eyes* deep, mostly at rose end, *eyebrow* distinct, *skin* yellowish, often showing purple specks, purple shade frequently showing in dent at heel; *flesh* **decidedly yellow.**

Sprouts.—Markedly purple, strong, numerous fine hairs.

Foliage.—*Haulm* upright, tall, vigorous; *stems* **very numerous, thin, hard, wiry,** mottled blue-purple, later merging into large patches of colour; *leaf* fairly close, due to shortness of leaflet stalks, *midrib* **has colour developed only at base and at bases of leaflet stalks, where colour stands out as distinct spots;** *leaflets* large, dark green, fairly glossy, dull, due to numerous fine hairs on surface, an occasional *terminal* tied; *secondaries* medium size, rounded.

Flower.—Dark blue-purple, tipped white, moderately numerous, small *anthers* frequently irregular and malformed, sometimes quite regular and well developed; *buds* **markedly dark purple, no portion green,** early buds mostly drop without opening; *flower cluster stalk* short and thin, *flower stalks* short, carrying buds erect or horizontal.

Maturity.—Late maincrop.

Disease Resistance.—Immune from Wart Disease. Leaf Roll rarely found on stocks, but if present, effects severe. Tolerant of

several of the Mosaic Diseases, and is a carrier of Virus B. Now subject to Blight, but all reports for ten years after its introduction declare wonderful Blight resistance. Not subject to Black Leg.

General Notes.—Raised and introduced by John Nichol, Ochterloney, seed sown in 1863, variety introduced 1876. Parentage unknown. Probably the most generally popular variety ever grown in Ireland. In 1886 the Champion occupied 79.8 per cent. of the total acreage under potatoes in Ireland. It is still grown to a considerable extent for home consumption in parts of Ireland and the Highlands of Scotland. *Yield* fair, *quality* superb, *keeps* well. Selected stocks still show wonderful vigour.

CHAMPION II,

Tuber.—Round; *eyes* large and deep; *skin* white; *flesh* very pale yellow.

Sprout.—Pink.

Foliage.—*Haulm* medium to tall, vigorous; *stems* branching, *leaf* open, fairly rigid, trace of red-purple in *midrib; leaflets* dull **grey-green,** hairy; **secondaries** not large, numerous.

Flower.—White, fairly large, numerous, *anthers* orange; *buds* dull red-purple; *flower cluster stalk* long and strong; *flower stalks* long, with buds drooping, *berries* frequent.

Maturity.—Late maincrop.

Disease Resistance.—Immune from Wart Disease. Wonderfully resistant to Blight and to Stalk Disease.

General Notes.—Raiser not definitely known, attributed to the late Mr. Robertson, "La Mancha," Malahide, Co. Dublin. Introduced by Messrs. Hogg and Robertson, Dublin, and Messrs. Dobbie & Co., Edinburgh, in 1903. *Yield* medium, *quality* poor, *keeps* well. Not a commercial success. This variety has disappeared.

CHAMPION'S HEIR.

Tuber.—Round, deep dent at heel end, *eyes* deep, *eyebrow* indistinct, *skin* white, *flesh* pale lemon, firm.

Sprout.—Pink.

Foliage.—*Haulm* erect, fairly tall; *stems* numerous, show practically no colouration; *leaf* open, fairly large, no colour in *midrib; leaflet* dark greyish green, long, hairy, **characteristic shape, tapering gradually from centre to tip;** *secondary leaflets* small.

Flower.—White, large, numerous; *buds* **green,** *anthers* orange, *flower cluster stalk* long and strong.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised by Thompson Browne, Smithborough, Co. Monaghan, about 1917. Of no commercial importance.

CLAYMORE.

Tuber.—Round, somewhat flattened, *eyes* shallow; *skin* white; *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* tall, upright, vigorous; *stem* strong, shows little colour; *wings* waved; *leaf* close, drooping; *leaflets* **broad, light, green,** long.

Flower.—White, numerous, clustered; *buds* green.

Maturity.—Late maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Introduced by D. & W. Croll, Dundee, 1927. *Yield* medium, tubers too small, numerous. Never grown to any extent.

COLOSSAL.

Tuber.—Oval to long, *eyes* very shallow, *eyebrow* scarcely noticeable, *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* tall, erect; *stems* show practically no colouring; *wing* fairly broad, straight; *leaf* fairly close, small; *midrib* faint reddish purple, with colour most pronounced at base and at base of leaflet stalks; *leaflets* small, rather light green; *terminal* often overlapped; *secondaries* fairly numerous, small rounded.

Flower.—Very pale reddish purple, tips white, rarely produced; *buds* fairly numerous, green, slightly tinged purple, drop readily; *sepals* long, hairy; *flower cluster stalk* short; *flower stalks* short.

Maturity.—Second Early.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Put on market by C. Fidler, Reading, 1892, raised by G. Brown, Walsall. Also known as St. Malo Kidney.

CORONA.

Tuber.—Round, *eyes* medium depth, *eyebrow* present, curved; *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* **tall, upright,** becoming a bit spreading towards maturity; *stem* bronzed, *wing* waved; *leaf* close; not much colouring on *midrib; leaflets* medium green, slightly wrinkled, arched, terminal generally overlapped; *secondary leaflets* large.

Flower.—White, very rare; *buds* small, green.

Maturity.—Late maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Not of commercial importance. Introduced by Reid.

CORONATION.

Tuber.—Round to oval, small; *eyes* shallow; *skin* white, a reddish tinge develops at *heel*; *flesh* white.

Sprouts.—Pink.

Foliage.—*Haulm* low spreading, straggly; *stems* show little colour in early stages except at base, colour develops towards maturity, wide, generally crinkled; *leaf* **open,** *midrib* free of colour except at base and bases of leaflet stalks; *leaflets* medium green, glossy, **drooping, pointed,** *terminal* overlapped, *leaflet stalks* long, sometimes bearing secondaries; *secondaries* very small, not numerous.

Flower.—None develops.

Maturity.—First early.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Introduced by the late J. Gardiner, M.P., 1915. There is a purple-skinned non-immune variety of this name, and also an immune variety, Coronation Kidney, tested at Ormskirk, 1916.

CRIMSON BEAUTY.

Tuber.—Oval, elongated; *eyes* very shallow, mostly on point of tuber; *eyebrows* present *skin* bright pink with colour more pronounced in eyes; *flesh* white, slight pink tinges.

Sprouts.—Deep pink.

Foliage.—*Haulm* low, spreading; *stems* considerably coloured, with colour more pronounced at nodes, *wing* straight; *leaf* open, drooping, *midrib* with colour very pronounced at base and bases of leaflet stalks; *leaflets* medium to dark green, small; *secondaries* numerous.

Flower.—White, very rare; *flower cluster stalk* very short, thin.

Maturity.—Second early

Disease Resistance.—Immune from Wart Disease.

General Notes.—Introduced by Messrs. Sutton & Sons, Reading, 1909. Grown only as an exhibition variety.

CRUSADER.

Tuber.—Kidney, frequently tapering; *eyes* shallow, *eyebrow* distinct only on eyes on side of tuber; *skin* white, *flesh* white.

Sprout.—Faint pink, with pink tip.

Foliage.—*Haulm* medium height, semi-erect; *stem* tinged red-purple towards maturity; *wing* waved near top of plant; *edge of wing* coloured near top of plant; *leaf* fairly close, **arched,** *young growth at top* sulphury, no colour in *midrib; leaflets* **rounded, markedly crinkled,** glossy, **characteristic shade of green,** terminal overlapped; *secondaries* not numerous; fairly well developed.

Flower.—Red-purple tipped white, not numerous; *buds* green base and tips with red purple markings, drop readily; *flower cluster stalk* short, *flower stalk* short.

Maturity—Early maincrop.

Disease Resistance.—Immune from Wart Disease. Virus Y causes Leaf Drop Streak.

General Notes.—Raised by the late Dr. Wilson, St. Andrews, in 1913, introduced by W. Wess, Elie, Fife, in 1918, and by Messrs. Wotherspoon, Donald and George Graham, Glasgow, 1919. *Yield* poor, a large number of small tubers. This variety proved very disappointing.

DI VERNON.

Tuber.—Oval to long, very regular, *eyes* very shallow, *eyebrow* long and distinct, *skin* yellow spashed blue-purple, particularly towards rose end; *flesh* white, tinged lemon.

Sprout.—Deep purple.

Foliage.—*Haulm* spreading, medium height, vigorous; *stem* develops some colour, *wing* waved; *leaf close*, due to numerous secondary leaflets, fairly large, **drooping,** *midrib* shows no colouring except an occasional tinge in axil of leaflet stalk; *leaflet* **dark green, glossy, medium size,** *stalks* frequently bear secondaries, last pair generally overlap terminal; *secondaries* rather small, pointed.

Flower.—Blue-purple, tipped white, not numerous; *buds* numerous; **remarkably dark blue-purple,** *hairs* numerous, very distinct, upstanding; *flower cluster stalk* fairly long, deep purple; *flower stalks* short, buds more or less horizontal to drooping.

Maturity.—First early.

Disease Resistance.—Immune from Wart Disease. Very subject in some seasons to Dry Rot during storage. Leaf Roll not seen on this variety in Ireland. If present, effects very severe. This variety is remarkable as being a "carrier" of no less than four viruses, Y, X, B and D, when each is present alone, but a combination of two or more of these viruses, present in the plant together, has often very severe effects.

General Notes.—Raised and introduced by A. Findlay, Auchtermuchty, in 1922. Stocks were badly infected with Leaf Roll and Mosaic. Healthy stock raised in Ireland from a plant selected in 1924. *Yield* good, *quality* excellent, *keeps* poorly in general, otherwise an excellent variety.

DONARD.

Tuber.—Oval, *eyes* shallow, *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* medium to tall, spreading; *stem* branching; *leaf* long, faint tinge of colour in *axil of leaf* and at *base of leaflet stalks; leaflets* light to medium green, large, *terminal* not usually overlapped; *secondary leaflets* large and well developed.

Flower.—None observed; *buds* small and dark coloured, drop readily.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Discovered by S. Donnon, Potato Inspector, Ministry of Agriculture, Northern Ireland, in a crop of Arran Consul in 1927. Believed to be a seedling of Mackelvie's that was mixed among Arran Consul. Tubers rather on the small side to be a commercial success.

DOON EARLY.

Tuber.—Round to oval, *eyes* medium to deep, *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* tall, upright with a close compact appearance; *stem* strong with *nodes* swollen; very little purple colouring; *wing* straight; *leaf* open; *leaflets* large and broad, medium to dark green; *secondary leaflets* very inconspicuous.

Flower.—White numerous, *flower cluster stalk* short; *berries* occasionally produced.

Maturity.—First Early. Promises to be a week earlier than Epicure.

Disease Resistance.—Immune from Wart Disease. Fairly tolerant of the Mosaic Diseases.

General Notes.—Raised and introduced by McGill and Smith, Ayr, in 1936-37. *Parentage* Puritan X Herald. Awarded the Finlayson Gold Medal in the Scottish Trials and registered by the Department of Agriculture for Scotland in 1934. Awarded a Lord Derby Gold Medal in the Ormskirk Trials, 1936. *Yield* good; *quality* medium.

DOON PEARL.

Tuber.—Round, *eyes* shallow; *skin* white with pink tinge at heel end; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* tall, strong, upright; *stem* strong, reddish purple mottling, *wing* thick, crinkled; *leaf* close; *leaflets* long, pointed, hard, dull; *secondary leaflets* large and numerous.

Flower.—White, very numerous, lasting; *anthers* orange; *flower cluster stalk* long.

Maturity.—Late maincrop.

Disease Resistance.—Immune from Wart Disease. Tubers subject to Blight.

General Notes.—Raised and introduced by McGill and Smith, Ayr, in 1932. Awarded a Lord Derby Gold Medal in the Ormskirk Trials, 1932. Not a commercial success, though it was expected to replace Arran Chief.

DOON STAR.

Tuber.—Oval, *eyes* shallow, *skin* white, *flesh* pale lemon, practically white.

Sprout.—Purple.

Foliage.—*Haulm* fairly tall, upright, compact, moderately vigorous; *stems* bronzed slightly, colour pronounced at nodes and at base, *wings* straight, fairly broad; *leaf* fairly open, *midrib* shows colour at base and in axils of leaflet stalks, *leaflets* **grey-green, long,** narrow, erect, harsh appearance; *secondaries* small, not numerous, mostly rounded, *young growth* sulphury.

Flower.—White, not numerous, *anthers* orange, *buds* reddish purple, *flower cluster stalk* thin and fairly short, *flower stalks* medium.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. In its early years suffered from Dry Rot (now believed to be Gangrene).

General Notes.—Raised and introduced by Messrs. McGill and Smith, Ayr, in 1926. This variety was of no commercial importance until 1933. From 1934 onwards its increase in popularity was phenomenal in Great Britain: acreage rose from 1,949 acres in 1934 to 8,918 acres in 1936.

DREADNOUGHT.

Tuber.—*Round*, dent at *heel; eyes* deep, *eyebrow* indistinct; *skin* white with very pale pink colouring showing only in patches; *flesh* white

Sprouts.—Pink, with tip pink. No hairs present.

Foliage.—*Haulm* spreading, fairly vigorous; *stems* numerous, thin, develop very little colour; *leaf* small, *leaflets* small, dark green.

Flower.—White, very numerous.

Maturity.—Late Maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight.

General Notes.—Origin unknown. Procured from Navan district, Co. Meath, in 1923. Also procured under the name Moore's Fancy. Of no commercial value. The name Dreadnought has been applied to Up-to-date and Templar.

DUKE OF KENT.

Tuber.—Round; *eyes* medium to shallow; *skin* white; *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* tall, strong; *stem* shows very little colouring, *wing* crinkled; *leaf* long, arched, *leaflets* dark green, large, waxy appearance; *secondary leaflets* large.

Flower.—White, numerous, *buds* green; *anthers* orange.

Maturity.—Late Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised and introduced by Messrs. Sutton and Sons, in 1935. *Parentage* Flourball X unnamed seedling. *Yield* good; *quality* poor; *keeps* well.

DUKE OF PERTH.

Tuber.—Oval, thick, *eyes* shallow, *eyebrow* long, *skin* white, *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* fairly tall, upright; *stems* strong, branching freely below ground, mottled dark blue purple, *wings* waved at the tops only, colour very pronounced on *edge of wing* at top of plant, two dark lines on *midrib* continued on leaflet stalks in young leaves, practically disappears later, *leaflets* dull, medium green, small, pointed; *secondaries* fairly numerous, not large.

Flower.—None observed; *buds* numerous, very dark, blue purple, drop readily; *flower cluster stalk* fairly short, *flower stalks* short.

Maturity.—Late Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised and introduced by G. H. Young, Meigle, 1927. *Yield* medium, tubers rather small and numerous. Not a commercial success.

DUKE OF YORK.

Tuber.—Thick kidney; *eyes* very shallow and mostly on point of tuber; *eyebrows* scarcely noticeable; *skin* thick, **markedly yellow; *flesh* decidedly yellow,** probably more so than any variety in cultivation except Champion.

Sprouts.—Faint pink base, white tips covered with fine hairs. Sprouts strong and very early.

Foliage.—*Haulm* semi-erect, low to medium height; **very little colour** on *stem*, *stem* branching, branches thin; *leaf* **long and open,** no colour in *midrib; leaflets* **long, narrow** and **pointed,** dull; *secondary leaflets* not numerous, small and rounded.

Flower.—White, practically never blooms; *anthers* pale and malformed; *buds* small, greenish purple, hairy, *hairs* short; *flower cluster stalk* short, *flower stalks* very short, carrying buds erect or horizontal.

Maturity.—One of the earliest varieties.

Disease Resistance.—Susceptible to Wart Disease. Readily attacked by Blight. Not very subject to Dry Rot. " Carrier " of Virus B, intolerant of most of the virus diseases, Virus Y produces Leaf Drop Streak.

General Notes.—Midlothian Early is identical with this variety. *Yield* good, *quality* good, *keeps* badly. **Bolters** frequently occur. Raised by W. Sim, Greenmyre, Fyvie, Aberdeenshire, and introduced by Messrs. Daniels, 1891. An important commercial variety.

DUNAVERNEY.

Tuber.—Round to oval, *irregular*, *eyes* medium, *skin* white, *flesh* white.

Sprouts.—Purple.

Foliage.—*Haulm* tall, upright; *stems* slightly mottled purple, branching freely, *wings* broad, slightly waved; *leaf* **open,** rigid; *leaflet* **dark green,** broad, glossy, *leaflet stalks* long, frequently bearing secondaries; *secondary leaflets* rather small, fairly numerous.

Flower.—White, large, numerous; *anthers* deep yellow, regular; *buds* dark blue purple, with very pronounced green base; *flower cluster stalk* fairly long, *flower stalks* long, with buds drooping.

Maturity.—Late maincrop.

Disease Resistance.—Immune from Wart Disease. Very intolerant of the virus diseases. Variety becomes unrecognisable.

General Notes.—Raised at Dunaverney, Co. Antrim, in 1923. *Yield* fairly good, *quality* medium, *keeps* well. Not a commercial success.

DUNBAR ARCHER.

Tuber.—Oval, thick, not so long as Dunbar Standard; *eyes* medium to shallow; *skin* white; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* tall vigorous, upright; *stem* very strong, freely branching, little colouring; *wing* very wavy; *leaf* rigid, *midrib* pink in leaf axil and at base of *leaflet stalks; leaflets* medium green and pointed; *secondary leaflets* numerous.

Flower.—White, decidedly more numerous than in the case of Dunbar Standard; *anthers* orange; *buds* pink; *flower cluster stalk* fairly long and strong.

Maturity.—Maincrop, possibly a little earlier than Dunbar Standard.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight; Leaf Roll not seen in this variety.

General Notes.—Introduced by Charles T. Spence Dunbar in 1936-37. *Quality* very good, *keeps* well. If the yield is sufficiently heavy this might be a useful variety though the tuber is not so attractive as that of Dunbar Standard.

DUNBAR CAVALIER.

Tuber.—Oval; *skin* white, rough, traces of pink, but not nearly so much as on King Edward; *eyes* and *eyebrows* pink, *eyes* shallow, *eyebrows* on sides of tuber long; *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* medium height to tall, upright, spreading later; *stems* branching; *leaf* open and rigid, pointing upwards, *midrib* of young leaves coloured at base of leaflet stalks: *leaflets* small, ashy green to dark green, dull.

Flower.—Red purple, tipped white, profuse; *buds* dark; *berries* occur.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight. Seems to be very susceptible to Leaf Roll, and its effects are severe.

General Notes.—Introduced by Charles T. Spence, Dunbar, in 1930-31. For a few years it promised to replace King Edward, but did not take well in the English markets. Acreage now very much reduced. *Parentage*, Majestic x H24, a non-immune seedling of Edward type, a cross of Admiranda x King Edward.

DUNBAR ROVER.

Tuber.—Oval, *eyes* shallow, *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* tall, upright, vigorous; *stem* very strong, thick, colouring towards maturity; *wing* broad; *leaf* short, not many pairs of leaflets, open; *leaflets* ash green, dull, long, broad, *leaflet stalks* long; *secondary leaflets* numerous, often borne on leaflet stalks.

Flower.—White, large, numerous; *buds* fairly dark, *flower cluster stalk* long and strong.

Maturity.—Second Early.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight. Appears tolerant of the Mosaic Diseases.

General Notes.—Introduced by Charles T. Spence, Dunbar, in 1936-37. Registered by the Department of Agriculture for Scotland in 1936. *Yield* fair, *quality* **exceptionally good;** very dry and floury, quite as good as British Queen at its best; *keeps* well. If the yield is sufficiently heavy this variety should be an assured success on account of its quality and consistent shape. *Parentage* Herald X Arran Consul.

DUNBAR STANDARD.

Tuber. Long oval, *shape* remarkably regular and free from second growth; *eyes* shallow; *skin* white; *flesh* white. A very attractive tuber.

Sprout.—Pink.

Foliage.—*Haulm* very **tall,** remarkably **vigorous,** upright; *stem* very strong and branching, very little colouring; *wing* broad, finely waved; *leaf* **short,** rigid, close, due to very large secondaries and short leaflet stalks, very little colour in midrib; *leaflets* **greyish green,** dull, **exceptionally large,** some have measured 6½ inches in length by 4½ inches in breadth, probably the largest leaflets of any variety in cultivation; *secondary leaflets* very large, fairly numerous, occasionally on leaflet stalks.

Flower.—White, usually not numerous; *anthers* yellow, usually malformed; *style* **bent** or **twisted,** a most unusual feature; *sepals* fairly long; *buds* greyish green, sometimes drop readily, not hairy; *flower cluster stalk* moderately strong, green; *flower stalk* medium length, buds droop slightly.

Maturity.—Maincrop, if anything a little late, but certainly no later than Kerr's Pink.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight, appears tolerant of the Mosaic Diseases; Leaf Roll was rather common in nucleus stocks, but this may have been due to accident, effects of Leaf Roll are very severe.

General Notes.—Introduced by Charles T. Spence, Dunbar. Awarded a Lord Derby Gold Medal in Ormskirk Trials, 1936. Registered by the Department of Agriculture for Scotland, 1936. *Yield* fairly good. If the yield is sufficiently heavy the variety appears very promising in other respects, *quality* very good, keeps well. A new variety well worthy of trial.

DUNBAR YEOMAN.

Tuber.—Flattened oval, very regular; *eyes* shallow; *skin* yellow; *flesh* pale yellow.

Sprout.—Faint pink.

Foliage.—*Haulm* spreading, fairly vigorous; *stem* fairly strong, slightly bronzed, no branching, *wing* slightly waved; *leaf* fairly close, no colour on *midrib; leaflets* decidedly large, flat, terminal occasionally tied; *secondary leaflets* fairly large, few.

Flower.—None seen, *buds* drop readily.

Maturity.—Genuine first early.

Disease Resistance.—Immune from Wart Disease. Very susceptible to Blight; Leaf Roll effects very severe. Very intolerant of some of the Virus Diseases, often prematurely killed when grown where conditions favour these diseases.

General Notes.—Introduced by Charles T. Spence, Dunbar, in 1933. *Yield* good, *quality* fair, *keeps* badly. *Parentage* Duke of York x Herald.

DUNOTTAR CASTLE.

Tuber.—Oval, elongated; *eyes* shallow, *eyebrows* indistinct, *skin* white, *flesh* white.

Sprouts.—Purple.

Foliage.—*Haulm* medium height, spreading; *stems* branching, considerable amount of blue purple colour on *stem; wing* slight but definite waving; *leaf* large, fairly close, *midribs* of young leaves coloured dark reddish purple, the colour continuing on the leaflet stalks and into the midrib; *leaflets* large, broad, dark green glossy; *secondaries* few, usually only one pair on each internode.

Flower.—Light bluish purple, tipped white, large; *anthers* yellow, well-formed, *buds* dark blue-purple; *flower cluster stalk* fairly long, *flower stalks* long.

Maturity.—First early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised by Rev. Aikman Paton about 1913 and introduced by Messrs. Sutton & Sons about 1914. Not extensively grown.

DUNVEGAN.

Tuber.—Flattened oval, very regular; *eyes* very shallow *eyebrow* present, curved; *skin* white, *flesh* decidedly lemon.

Sprout.—Purple.

Foliage.—*Haulm* medium height, more or less straggly; trace of blue-purple mottling on *stem*, *wing* practically straight, *leaf* open, fairly large, *midrib* light purple at base of leaf and base of leaflet stalks; *leaflet* fairly dark green, medium size, generally showing very pronounced mottling due to Mosaic disease, *leaflet stalks* long, frequently bearing secondaries : *secondary leaflets* round and often numerous.

Flower.—Large, very pale blue, almost white, not numerous; *buds* dark purple when fully developed, hairy, *hairs* upstanding and conspicuous; *flower cluster stalk* long, only slight mottling: *flower stalks* medium.

Maturity.—First early.

Disease Resistance.—Immune from Wart Disease. Withdrawn from the market in 1924, due to the whole stock being badly affected with Crinkle, otherwise a very promising early variety.

General Notes.—Raised by Rev. Aikman Paton, Soulseat, Scotland. Introduced by Messrs. Sutton & Sons, Reading, in 1922. First tested at Ormskirk, 1919.

EARL OF ESSEX.

Tuber.—Round to long, rough, irregular, deep dent at *heel*; *eyes* deep, *eyebrow* pronounced, *skin* white splashed purple, with colour most pronounced in *eyes*, *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* erect, strong, vigorous: *stem* shows no colouration **except in leaf axil where there is a distinct purple tinge;** *leaf*

open, rigid, erect, *young growth* sulphury; *leaflet* medium size, pointed, crinkled, cupped, light green; *secondaries* not numerous, rounded, small.

Flower.—Light purple, fairly numerous; *buds* green, with purple markings; *flower cluster stalk* short, green, *flower stalk* short, deeply coloured.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Leaf Roll never seen on this variety in Ireland, but it was never extensively grown. Fairly resistant to Blight.

General Notes.—An old variety pretty widely scattered over Ireland. *Yield* good, *quality* fair, *keeps* well. Hardy. It is known as "Blue Eyes," "Farmer's Glory," etc.

EARL OF ESSEX "ROGUE."

Tuber.—Resembles Earl of Essex, but *skin* all white.

Sprout.—Purple.

Foliage.—*Haulm* tall, erect, vigorous; *stem* thick, strong mottled blue-purple, colour develops more towards maturity; *wing* slightly waved; *leaf* **markedly rigid,** close, due to short internodes and short leaflet stalks; *midrib* of young leaves shows a trace of colour, disappears later, *centre of midrib* ridged, causing two conspicuous grooves; *leaflets* crinkled, probably due to Mosaic, though mottling not conspicuous, inclined to be rounded; *secondaries* few, small, rounded.

Flower.—Dark blue purple distinctly white-tipped, numerous; *anthers* pale yellow, usually malformed; *buds* very numerous, dark blue purple; *hairs* not conspicuous; *flower cluster stalk* long mottled blue-purple, *flower stalks* long, deeply coloured, with buds drooping.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—An old, but very vigorous variety found among Earl of Essex. Its name is unknown.

EARLY MANISTEE.

Tuber.—Oval, elongated; *eyes* medium, *eyebrows* long; *skin* pink; *flesh* white.

Foliage.—*Haulm* medium height, spreading; *stem* branching,

mottled red purple, *wings* waved; *leaf* open, *midrib* shows colour only at base and at bases of leaflet stalks, except in young leaves, where colour is continuous; *leaflets* medium green, dull.

Flower.—White, fairly numerous; *anthers* pale yellow, malformed; *buds* dark red purple.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—An American variety. This variety was sent by Wm. Adams, West Kilbride, Ayr, to Ormskirk to be tested under the name Ardneil Rose in 1922. Not a commercial success in Great Britain. Never grown to any extent in Ireland.

EARLY MARKET.

Tuber. -Flattened oval to long, generally small; *eye* shallow, *eyebrow* distinct and curved; *skin* white, *flesh* white.

Sprout.—Pink

Foliage.—*Haulm* medium height, semi-erect; *stems* fairly numerous, develop very little colour except at base, *wings* waved; *leaf* rigid, close, with numerous secondary leaflets; no colour in **midribs** except a tinge of pink in axil of leaflet stalks; *leaflet* **yellow-green, hairy, small, crinkled;** *secondaries* rounded, fairly well developed.

Flower.—Light red-purple with white tips, rarely blooms, small; *buds* hairy, green at base and tips, deep red-purple band near base, and red-purple lines; *flower cluster stalk* short, *flower stalks* very short.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight. Leaf Roll not observed.

General Notes.—Raised by R. Fenn, Sulhampstead, and introduced by Messrs. Sutton & Sons, Reading. Another variety was introduced by Messrs. Sutton & Sons under the same name in 1888, but it has disappeared. The Early Market described in "Twentieth Century Potatoes" is a coloured variety.

This variety is of no commercial importance, but occurs very frequently as a "rogue" amongst nearly all white varieties, particularly Great Scot and Up-to-date.

EARLY OHIO.

Tuber.—Round to oblong, *eyes* deep, *skin* light pink, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* erect; *stem* shows considerable amount of reddish purple colour, developing towards maturity, *wing* wide and straight; *leaf* decidedly open, long internodes, *midrib* light reddish purple, with colour deep at base of leaflet stalks. On young leaves colour carried on *leaflet stalks* and well into *midrib of leaflet*. In older leaves colour near base of leaflet midrib is more pronounced than in leaflet stalk. *Leaflets* fairly large, medium green, *leaflet stalks* long, sometimes bearing a pair of secondaries; *secondary leaflets* not numerous, pointed.

Flower.—None observed; *buds* small deep purple, hairs numerous short, drop before opening; *flower cluster stalk* very short, *flower stalks* short.

Maturity.—Early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—An American variety. Of no importance in this country.

EARLY REGENT.

Tuber.—Flattened round to oval; *eyes* shallow, *eyebrow* indistinct, *skin* white, thin, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* low, decidedly spreading; *stems* have short internodes, mottled reddish purple, with colour developing towards maturity; *wing* straight, *leaf* fairly close, **flat;** *leaflets* large **yellowish green, thick, very hairy,** pointed, *leaflet stalks* very short. *Secondaries* fairly numerous and well developed, rounded.

Flower.—White, large, **rare,** only one or two flowers in each cluster, *flower buds* reddish purple, green tips, drop readily, not numerous; *flower cluster stalks* short, *flower stalks* short, *berries* occur.

Maturity.—Second early.

Disease Resistance.—Susceptible to Wart Disease. Aucuba Mosaic always present.

General Notes.—Raised by Robert Fenn, Sulhampstead, and introduced by Messrs. Sutton & Sons, Reading. Awarded a first-class certificate by Royal Horticultural Society, 1893. There have been other varieties grown under the name Early Regent. Not now grown (1937). Occurs occasionally as a " rogue."

EARLY ROSE.

Tuber.—Oval to long, frequently tapering towards rose end; *eyes* fairly deep, *eyebrow* very distinct; *skin* bright pink all over tuber; *flesh* white, frequently with traces of pink in flesh, flesh soft and brittle.

Sprout.—Bright Pink.

Foliage.—*Haulm* spreading, medium height; **colour** on *stem* pronounced, much more so than on Beauty of Hebron; *leaf* open, long, colour in *midrib* very pronounced, **with colour carried into leaflet stalks and well into midrib of leaflets in young leaves ;** *leaflets* fairly large, rather pale green colour, pointed. *Secondary leaflets* small, very few present.

Flower.—White, fairly numerous; *anthers* generally orange, sometimes pale yellow, *style* protruding well above anthers. Some flowers had pale, deformed *anthers* in same cluster where other flowers had ordinary well-developed anthers; *buds* reddish purple, not so deeply coloured as British Queen, hairy; *sepals* **long** and green; *flower cluster stalk* fairly long, flattened on one side; *flower stalk* deeply coloured, long.

Maturity.—First early.

Disease Resistance.—Susceptible to Wart Disease and to Blight. Leaf Roll never observed. Very tolerant of the virus diseases.

General Notes.—*Yield* good, *quality* fair, *keeps* badly. Raised by A. Bresee, Habbardson, Vermont, U.S.A., in 1867. This variety was once very popular for garden cultivation, but has largely gone out of favour on account of its bad keeping quality. There is still, however, good demand for the small quantity grown for seed purposes in the South of England, in France and in South Africa. The vigour of this variety as still grown in the Athlone bogs is remarkable. It has been grown in this district without a change of seed for over 50 years.

EARLY TEMPLAR.

Early Templar is more bushy, but otherwise very similar in appearance of foliage to Templar. Large pair of secondaries come off very close to first pair of primaries on Early Templar. On Templar they come off about ½-inch or more further along midrib. Templar bloom persists. Early Templar bloom falls off early. Early Templar is very subject to blight. See Templar.

ECLIPSE.

Tuber.—Flattened oval, sometimes tapering to both ends; *eyes* very shallow, *eyebrows* very indistinct; *skin* white, *flesh* pure white.

Sprout.—Pink, decidedly deeper in colour than Sharpe's Express. Hairy.

Foliage.—*Haulm* medium height and spreading; *stems* **develop a very considerable amount of reddish purple colour**, and are almost completely coloured towards maturity, resembling Epicure in this respect; *stem* **solid until it begins to ripen,** *wing* broad; *leaf* fairly close, due to short internodes, only trace of colour in *midrib; leaflet* small, hairy, and of a medium greyish green colour, dull; *secondaries* not numerous, rounded, small.

Flower.—White, not numerous; **characteristic deep reddish purple** on *flower stalks* and *base* of *buds*, green tips, hairy; *anthers* malformed, pale yellow; *buds* numerous, *sepals* fairly long, *flower cluster stalk* fairly short, carrying flowers about level with top of foliage, coloured; *flower stalk* medium, buds drooping.

Maturity.—Classed as first early, but decidedly later than Epicure, May Queen, Duke of York, Ninetyfold, or Arran Pilot, *nearly* as early as Sharpe's Express.

Disease Resistance.—Susceptible to Wart Disease. Leaf Roll effects severe, but very rare in Ireland. Tolerant of the virus diseases; a "carrier" of Virus B, though Virus Y produces Leaf Drop Streak and Virus X causes a pronounced mottle. Not subject to Blight.

General Notes.—This variety was first named after Sir John Llewelyn, President, National Potato Society. *Yield* fairly good: *quality* good, *keeps* well. The most popular early variety in England. Grown chiefly in Kent, Sussex, Norfolk, Lincolnshire, Cambridgeshire, Lancashire. Grown in trial plots in Co. Down in 1904, and was in cultivation some years at that time.

EDGECOTE PURPLE.

Tuber.—Kidney to long; *eyes* very shallow; *skin* deep purple; mottled tubers have occurred; *flesh* pale yellow.

Sprout.—Deep purple.

Foliage.—*Haulm* upright, later spreading, moderate vigour, *stem* develops **very large amount of colour,** *wing* straight; *leaf* open, drooping, *midrib* deeply coloured, with colour carried into leaflet stalks; *leaflet* dark grey-green, medium size, crinkled, dull; *secondaries* small, dull.

Flower.—White, with blue blush, large, numerous, persistent; *anthers* orange, regular; *style* very long; *buds* purple; *flower cluster stalk* short, thin, *flower stalks* medium.

Maturity.—Second Early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised by —— Wilde, Edgecote. *Yield* light, *quality* good, *keeps* well. Grown only for exhibition purposes.

EDINBURGH CASTLE.

Tuber.—Oval, flattened; *eyes* very shallow, *eyebrow* prominent, *skin* white, *flesh* tinged lemon.

Sprouts.—Faint pink.

Foliage.—*Haulm* medium height, spreading; *stems* tinged pink, *wing* crinkled; *leaf* open, *leaflets* large, glossy, rounded, drooping, *secondaries* not numerous.

Flower.—White, very rare, *buds* pale green; *flower cluster stalks* short.

Maturity.—Second Early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised by Rev. Aikman Paton, Soulseat, Scotland, and introduced by Messrs. Sutton & Sons, Reading, 1913. Never grown to any extent.

EDZELL BLUE.

Tuber.—Flattened round, inclined to be oblong; *eyes* deep, *eyebrow* long and distinct; *skin* deep purple and often netted; *flesh* **snow-white.**

Sprout.—Dull dark purple; fairly vigorous.

Foliage.—*Haulm* upright, medium height, liable to become straggly; *stem* mottled purple with colour more pronounced in leaf axils; *leaf* decidedly open, long, drooping; *midrib* coloured only at base and in axils of leaflet stalks; *leaflet* **narrow and pointed, characteristic bluish-green colour;** *leaflet stalks* long, sometimes bear secondaries; *secondaries* fairly numerous, pointed.

Flower.—White, fairly numerous; *buds* dark purple at base with green tips; *flower cluster stalk* rather short; *flower stalks* short.

Maturity.—Early second early.

Disease Resistance.—Immune from Wart Disease. Leaf Roll if present causes very severe effects.

General Notes.—*Quality* good, *keeps* badly. Such varieties as Arran Victory, Peerless, Mill Street Hero, Fortyfold, Eightyfold, Herd Laddie, Edzell Blue Substitute may occur as impurities. A very old variety.

EDZELL BLUE SUBSTITUTE.

Tuber.—Oval; *eyes* shallow, much more so than Edzell Blue; *eyebrows* short, distinct; *skin* deep purple; *flesh* **decidedly lemon.**

Sprout.—Dull deep purple.

Foliage.—*Haulm* erect; plenty of colour on *stem* more so than on Edzell Blue; *leaf* long and fairly open despite numerous secondary leaflets, *midrib* slightly coloured, with colour most pronounced at base and at base of leaflet stalks; *leaflet* crinkled, fairly large, light green, *leaflet stalks* long, with secondaries on leaflet stalks; *secondaries* numerous, large.

Flower.—Bluish purple, with tips nearly white; few flowers produced; *buds* fairly numerous, drop readily, small, green with purple lines; *flower cluster stalk* short, *flower stalk* very short and coloured.

Maturity.—Early second early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—The name of this variety is not known. It has been sold as Edzell Blue.

EIGENHEIMER.

Tuber.—Oval, pointed towards rose end; *eyes* medium to deep; *skin* yellow; *flesh* yellow.

Sprout.—Purple.

Foliage.—*Haulm* spreading, fairly tall; *stems* numerous, green not much purple colouring; *wing* straight; *leaf* fairly open, practically no purple colouring in *midrib*, *leaflets* long, narrow, pointed, **very dark green,** *terminal* often overlapped.

Flower.—White, rare; *anthers* pale, *buds* **markedly green,** not numerous; *flower cluster stalk* short.

Maturity.—Early maincrop.

Disease Resistance.—Susceptible to Wart Disease. Very susceptible to Blight.

General Notes.—A Dutch variety. Of no commercial importance in this country. *Yield* fairly good; *quality* good.

EIGHTYFOLD.

Tuber.—Flattened oval, approaching round, very uniform; *eyes* very shallow, *eyebrows* present, sharp and curved; *skin* light purple; *flesh* practically white.

Sprout.—Deep purple.

Foliage.—*Haulm* semi-erect, low; large amount of dark blue-purple colour on *stems*, branching, *wing* wide and waved, *leaf* open, drooping, *midrib* blue purple, with colour most pronounced at *base* of *leaf* and at *base of leaflet stalks*, colour continued on *leaflet stalk*, but only short distance into *midrib of leaflet; leaflet* large, **thin, pale green,** glossy, drooping, *leaflet stalks* sometimes bear secondaries; *secondaries* more or less rounded, not numerous.

Flower.—Light blue, small white tips, fairly numerous; *anthers* long, yellow, *style* long, protruding well above *anthers; buds* deep blue purple, very hairy, *flower cluster stalk* deeply coloured, very strong and thick, fairly long but arises low down on plant, carrying flowers among foliage, sometimes bears leaves; *flower stalks* fairly long, carrying buds in drooping position.

Maturity.—First early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised and introduced by the late A. Findlay, Markinch, in 1894. *Yield* fair, *quality* medium, *keeps* badly. Of no commercial importance.

EPICURE.

Tuber.—Round to oblong, slightly flattened, irregular; *eyes* deep, *eyes* on side of tuber slit-like, *eyebrow* very distinct; *skin* **white, becoming pink on exposure to light,** and only becomes green after long intensive exposure; *flesh* white, firm in cutting.

Sprouts.—Markedly pink.

Foliage.—*Haulm* semi-erect, strong and vigorous; *stem* **gradually develops reddish purple colour, and** *stems* **much exposed become almost completely coloured**, very few white varieties develop so much colour on stems; *wing* broad, slightly waved; *leaf* rather small, close, due to short internodes and fairly well-developed secondaries; *leaflet* medium green, **small, narrow, pointed, glossy,** last pair point forward and generally overlap *terminal*, *secondaries* fairly numerous.

Flower.—White, as a rule does not bloom profusely; *anthers* generally malformed and pale yellow; *flower buds* hairy, fairly

numerous, usually deep reddish purple, green tips, frequently drop early; *flower cluster stalk* not long except in case of "Bolters," *flower stalk* fairly short, carrying buds erect or horizontal.

Date of Maturity.—One of the earliest varieties.

Disease Resistance.—Susceptible to Wart Disease. Leaf Roll effects severe, but disease never seen on this variety in Ireland; very tolerant of some of the virus diseases; but Virus D and Virus X both cause Top Necrosis, while Virus Y causes only a mild mosaic mottling. Rather subject to Stem Canker in some districts; not subject to Black Leg; fairly resistant to Blight. Not subject to Dry Rot.

General Notes.—Very heavy cropper, good keeper, very hardy and best of all earlies to overcome the effects of frost. *Quality* poor. **"Bolters" frequently occur.** More extensively grown in Ireland and Scotland than all other first earlies put together. Not popular in England, though pretty extensively grown on account of its superior hardiness and earliness. Raised by James Clark, Christchurch, Hampshire, and put on the market in 1897 by Messrs. Sutton & Sons. Hardiest and most reliable of all early varieties.

EVERGOOD.

Tuber.—Oval, flattened: *eyes* shallow and mostly on point of tuber; *skin* white, *flesh* white, tinge of lemon.

Sprout.—Faint Pink.

Foliage.—*Haulm* semi-erect, tops drooping, *stems* numerous, thin, show no colouring, *wing* straight, *leaf* open, drooping, *leaflets* **narrow,** pointed, **dark green,** thick, glossy. *Secondary leaflets* small.

Flower.—Light red-purple, very rare, *anthers* pale yellow, malformed, *buds* light pink, drop very readily, fairly numerous. *Flower cluster stalk* short.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease. Fairly resistant to Blight.

General Notes.—Raised and introduced by A. Findlay, 1899. *Yield* good, *quality* poor, *keeps* well. For many years grown extensively in the Fen districts in the East of England.

FARMERS.

Tuber.—Round, rough, irregular, *eyes* medium to deep, *eyebrow* distinct, *skin* yellow with a faint purple colour towards rose end, *flesh* **yellow.**

Sprout.—Purple.

Foliage.—*Haulm* very tall, erect; *stems* thin, hard, develop a considerable amount of blue purple colour; *leaf* close, *midrib* coloured blue purple, colour most pronounced at base and at bases of leaflet stalks; *leaflet* crinkled, glossy, long and pointed, *terminal* frequently overlapped.

Flower.—Never seen. *Buds* dark blue purple over whole bud, no part green, small, drop readily; *flower clustar stalk* short, *flower stalks* short and deeply coloured.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Leaf Roll not seen.

General Notes.—Origin unknown. This old variety was procured in 1925 from County Cork, where it was grown in a few small patches.

FIELD MARSHAL.

This variety is identical with Up-to-date, except that the tubers have got a russet skin. This abnormality is a comparatively common feature of white varieties (see Golden Wonder and Sefton Wonder). A russet Arran Comrade and a russet Tinwald Perfection have also been discovered. Field Marshal was sent to Ormskirk by Messrs. Austin and McAslan, Glasgow, in 1920, and was put on the market by Messrs. Dobbie & Co., Edinburgh, in 1924. Grown to some extent, but not to a large extent, as a commercial variety.

FIFTYFOLD.

Tuber.—Oval, *eyes* shallow, *eyebrows* present, *skin* white, *flesh* white.

Sprouts.—Pink.

Foliage.—*Haulm* medium height, spreading; *stems* branching, mottled red-purple; *leaf* fairly close; *leaflets* medium to dark green, dull, rounded, *terminal* drooping. Aucuba Mosaic common; *secondaries* rounded, numerous.

Flower.—White, fairly numerous; *buds* dark red-purple, *berries* occur.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised by R. Fenn, Sulhampstead, and introduced by Messrs. Sutton and Sons Reading, 1882. Never grown to any extent.

FLOUNDER.

Tuber.—Flattened round; *eyes* fairly deep, *eyebrow* indistinct; *skin* white; *flesh* pale lemon.

Sprout.—Pink.

Foliage.—*Haulm* semi-erect; bronzing in *stem*, darkening and extending towards maturity, branching freely, *wing* fairly broad, sometimes waved; *leaf* fairly close, due to short internodes, usually small, very faint colour, if any, in *midrib*, developed most at base of leaf; *leaflet* small, **pale green, crinkled;** *secondaries* small, rounded.

Flower.—Reddish purple, with very small almost white tips, numerous; *anthers* yellow, well formed; *buds* green with purple base, *hairs* inconspicuous; *flower cluster* stalk fairly long, thin, rises near top of foliage; *flower stalk* short, coloured. *Flower stalk* emerges between two prominent circular leaflets.

Maturity.—First early.

Disease Resistance.—Susceptible to Wart Disease. Leaf Roll not seen on this variety in Ireland: now very subject to Blight.

General Notes.—Origin unknown. Very old variety, at one time grown very extensively as an early in Ireland. In 1880 nearly 50,000 acres were grown, and this acreage was remarkably equally divided over the four provinces. Only a very small acreage now grown.

FLOURBALL.

Tuber.—Round, dented at *heel; eyes* deep, *eyebrow* distinct but sunken; *skin* bright pink: *flesh* white, frequently trace of pink under skin at rose end.

Sprout.—Deep pink.

Foliage.—*Haulm* semi-erect, medium height; *stem* tinged reddish purple: *leaf* open, long, drooping, *midrib* generally deeply

coloured on young leaves, fading later; *leaflet* dark greyish green, dull, *leaflet stalks* very long, sometimes bearing secondaries; *secondary leaflets* fairly well developed, fairly numerous; the foliage of Flourball bears a strong resemblance to Shamrock, but between the first and second pair of primary leaflets in Shamrock there is generally a well-developed pair of secondaries resembling small primaries, these generally come off the midrib about middle way between the primaries. In Flourball, the corresponding pair of secondaries generally come off just at the base, or quite close to it, of the stalks of the first pair of primaries.

Flower.—White, with definite trace of reddish purple on back of petals, large, numerous; *petals* open more than in Shamrocks; *anthers* orange, well developed; *buds* dark reddish purple; *flower cluster stalk* long, *flower stalks* very long, flowers bending downwards; *berries* frequent.

Maturity.—Maincrop. Ripens much earlier than Shamrock.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight; Leaf Roll not seen on this variety.

General Notes.—Procured by Messrs. Sutton & Sons, Reading, from Miss L. King, Mountmellick, in 1895. *Yield* fair, *quality* good, *keeps* well. A popular variety at one time, and still grown in small quantities about the Midlands of Ireland.

FORTYFOLD.

Tuber. Round, *eyes* fairly deep, *eyebrow* distinct, *skin* fairly deep purple, **with numerous characteristic fairly large yellow splashes,** *flesh* pale lemon.

Sprout.—Purple.

Foliage.—*Haulm* semi-erect, inclined to become straggly, *young growth* sulphury, medium height, *stem* shows no colour, except at base; branching freely, *wing* pronounced, slightly waved in some places; *leaf* close, due to short leaflet stalks, no colour in midrib; *leaflets* small, **remarkably pale green,** crinkled, inclined to be rounded, *secondaries* small, rounded.

Flower.—Blue-purple, extremely rare; *buds* **green,** *hairs* short and inconspicuous, trace of colour at base, fairly numerous, *sepals* long, *buds* drop readily, *flower cluster stalk* short *flower stalks* short, green.

Maturity.—Early maincrop.

Disease Resistance.—Susceptible to Wart Disease. Very intolerant of the virus diseases, foliage becomes unrecognisable.

General Notes.—This old variety appears to be similar to Taylor's Fortyfold mentioned in Lawson's list, 1836. It is now of no commercial importance. There is a white-skinned selection, sometimes known as Shetland Early Regent, and also a russet-skinned selection known as Village Blacksmith.

GAWKIES.

Tuber.—Round, rough deep dent at *heel*, *eyes* very deep, *eye-brow* not distinct, *skin* white, *flesh* yellow.

Sprout.—Pink.

Foliage.—*Haulm* spreading; *stem* develops practically no colouring, *stems* **thin, numerous;** *leaf* small, fairly open, **rigid,** no colouring in *midrib; leaflet* small, **light green,** pointed, crinkled; *secondaries* very small, not numerous, rounded.

Flower.—White, rare; *buds* **markedly green, freely formed,** drop readily; *flower cluster stalk* long, green, *flower stalk* short, green.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Leaf Roll not seen.

General Notes.—Very old variety. Procured from Glenties district, Co. Donegal, in 1923, which is the only district where this variety is grown. Of no commercial value. Hardy, *keeps* well.

GIGANTIC.

Tuber.—Oval, elongated, *eyes* shallow, *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* medium height, spreading; *stem* branching, coloured at base and in leaf axils, *branches* thin and weak, *wing* straight; *leaf* open, *midrib* shows faint colour at base and at bases of leaflet stalks: *leaflets* ashy green, small, crinkled, *secondary leaflets* small.

Flower.—White, not numerous, backs of petals show trace of red-purplish colouring; *buds* dark red purple, drop readily.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised and introduced by A. R. Findlay in 1924. Never grown to any extent.

GLADSTONE.

Tuber.—Oval to kidney, if anything tending more towards round than King Edward; *eyes* pink, shallow; *skin* white with pink splashes closely resembling King Edward; *flesh* white.

Sprout.—Deep pink.

Foliage.—*Haulm* tall, erect, vigorous, becomes more spreading towards maturity; *stem* strong, branching freely, coloured at nodes and in leaf axil; *wing* straight; *leaf* **open,** due to long leaflet stalks, no colour in *midrib* except in leaf axil, fairly long; *leaflets* medium sized, **dark green** and **very glossy,** *terminal* drooping to perpendicular, *leaflet stalks* long; *secondary leaflets* small, numerous, often borne on *leaflet stalks.*

Flower.—White, numerous, *petals* very large; *sepals* large; *anthers* orange, regular, large; *buds* reddish purple; *flower cluster stalk* very long usually drooping, due to weight of bloom, green; *flower stalk* long, green.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight. Liable to Spraing on certain soils. This variety often shows a characteristic marginal roll of the leaflets especially in harsh weather or towards maturity. This rolling should not be mistaken for true Leaf Roll.

General Notes.—Raised by McGill and Smith, Ayr. Introduced by John Gibb, Gladstone Farm. Bishopton, Renfrewshire, as Ochiltree in 1932. Renamed Gladstone in 1933. Registered by the Scottish Department of Agriculture in 1934, and awarded a Lord Derby Gold Medal in the Ormskirk Trials, 1935. *Quality* excellent, *Yield* at least equal to King Edward and often better, *keeps* well. This variety promises to be an immune substitute for King Edward, though large tubers have in some cases shown hollowness. In many respects a good variety.

GLENCOE.

Tuber.—Round to oval, *eyes* shallow, *skin* white, *flesh* white.

Sprout.—Faint pink at base, white tips.

Foliage.—*Haulm* semi-erect; *stems* fairly numerous very little colour, *wing* broad, straight; *leaf* fairly close, no colour showing in *midrib* except at base of leaf and at base of leaflet stalks on young leaves; *leaflets* hairy, light green, fairly large; *secondaries* small, fairly numerous.

Flower.—Not observed. *Buds* green base and green tips, purple markings.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised by the late W. R. Farish, and sent to Ormskirk for trial by A. W. McAlister, Dumfries, 1926. Has not become of commercial importance.

GOLDEN WONDER.

See Maincrop. Golden Wonder is identical with Maincrop, except that the former has a russet-skinned tuber.

GREAT SCOT.

Tuber.—Flattish round, uniform, dent at *heel; eyes* medium, with the majority occurring on the shoulder of the tuber, *eyebrow* distinct, *skin* **slightly yellow,** *flesh* white.

Sprout.—Deep pink, thick, strong and vigorous.

Foliage.—*Haulm* tall, strong, upright, *stem* mottled red-purple developing towards maturity, deep reddish purple at base, *wing* straight; *leaf* fairly close, a bit **drooping;** *midrib* not much coloured: *leaflets* very dark green, somewhat glossy, medium size, *terminal* **markedly drooping;** *secondary leaflets* fairly well developed.

Flower.—White, practically never blooms, *anthers* pale yellow, malformed; *buds* **decidedly reddish purple, very little green showing,** drop readily; *flower cluster stalk* very short, arising from top of foliage; *flower stalks* **very short, carrying buds erect or horizontal,** never drooping.

Maturity.—Second early, but decidedly a week later than British Queen.

Disease Resistance.—Immune from Wart Disease. Leaf Roll effects not severe, but disease never seen on Great Scot in this country; very tolerant of the virus diseases, a "carrier" of Virus B. and Virus D. This variety shows less virus disease effects than any other variety in cultivation: rather subject to Powdery Scab; fairly resistant to Blight.

General Notes.—Raised by G. Muir, Lockerbie, in 1906, and introduced by A. W. McAlister, Dumfries, in 1909. *Yield* good, *quality* medium, *keeps* well. A most reliable cropper, but quality was never equal to British Queen. Bolters occur frequently. A russet-skinned sport was named Sefton Wonder.

"GREAT SCOT" ROGUE FROM KERR'S PINK.

Tuber.—Round, dented at *heel*, *eyes* medium depth, *eyebrow* present, *skin* pale pink, *flesh* white. **The tuber is practically indistinguishable from Kerr's Pink,** though generally the short axis is from rose to heel end.

Sprouts.—Deep pink.

Foliage.—*Haulm* tall, upright; *stem* distinctly mottled red purple, *wing* waved; *leaf* open, *midrib* red-purple, with colour very pronounced at the base and at bases of leaflet stalks; *leaflets* dark green, glossy, *terminal* drooping; *secondaries* fairly numerous. Until the plant begins to produce flowers, the foliage has a striking resemblance to Great Scot, except for the pronounced red-purple mottling.

Flower.—White, numerous *petals*, decidedly larger than in Kerr's Pink and a larger number of flowers in cluster *anthers* **orange,** *buds* like Kerr's Pink; *berries* frequent.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—This variety appears to have been in stocks of Kerr's Pink from the outset. Of no commercial importance except as a rogue in Kerr's Pink.

GREEN-BUDDED KERR'S PINK ROGUE.

This variety appears identical with Kerr's Pink, except that the stems do not develop quite so much colour, and the **flower buds are completely green and flower cluster stalk and flower stalks are green.**

GREEN CHAMPION.

Tuber.—Round very much flattened, short axis from rose end to heel, deep dent at *heel*, irregular; *eyes* medium to deep, *eyebrow* distinct, *skin* white or brownish, very thin, **generally purple marking in dent at** *heel; flesh* **white.**

Sprout.—Purple.

Foliage.—*Haulm* tall, erect; not much colour on *stem*, *leaf* open, rigid, no colour in *midrib; leaflet* rounded, light green.

Flower.—Light bluish purple, large numerous; *anthers* orange, well-formed; *buds* greenish purple, green tips, numerous. *Berries* freely formed; *flower cluster stalk* very long, *flower stalks* long.

Maturity.—Late maincrop.

Disease Resistance.—Susceptible to Wart Disease. Resistant to Blight.

General Notes.—Origin unknown. *Yield* fair, *quality* poor, *keeps* well. Grown to some extent, but not for sale, in the Midlands of Ireland. Also known as Brown Champion on account of colour of skin of tuber.

GREGOR CUP.

Tuber.—Round, deep dent at *heel; eyes* deep, more so than Kerr's Pink, *eyebrow* distinct; *skin* pink, frequently rough and netted; *flesh* very pale lemon, not quite white.

Sprout.—Pink.

Foliage.—*Haulm* tall; *stem* strong, showing **zig-zag appearance,** particularly near top of plant, branching freely, mottled red-purple, *wings* **markedly crinkled;** *leaf* rigid, short, fairly open; on *midrib* of young leaves and on leaflet stalks red-purple in two lines, on older leaves colour only in axils of leaflet stalks and at base of leaf; *leaflets* distinctly **greyish green, crinkled,** medium size; *secondaries* small, fairly numerous, sometimes borne on leaflet stalks.

Flower. White, tips green, practically never blooms; *buds* small, markedly **dark red-purple,** fairly numerous, drop readily; *flower cluster stalk* short, *flower stalk* very short.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Of no commercial value. Frequently found as a " rogue " in stocks of Kerr's Pink. A very old variety.

HADDINGTONS.

Tuber.—Round: *eyes* shallow, *eyebrow* present; *skin* white, with considerable amount of deep pink in eyes on majority of tubers, some completely white; *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* semi-erect, medium height; *stem* branching above ground, some reddish purple colour on *stem*, developing towards maturity; *leaf* open, no colour in *midrib; leaflet* fairly large, dark green and glossy, margins waved, cupped; *secondaries* small **and fairly numerous, have practically no stems giving characteristic appearance to leaf.**

Flower.—Dark reddish purple, large white tips, soon fades; *petals* large, only an occasional flower produced in cluster; *anthers* pale yellow, tips of anthers closely pressed to style, wide apart at centre, giving anthers barrel-shaped appearance; *buds* fairly numerous, fairly dark reddish purple, green tips, mostly drop off before opening; *flower cluster stalk* short, thin; *flower stalks* medium, buds drooping.

Maturity.—Early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Found as a " rogue " in crops in Co. Donegal Origin not known. Of no commercial value. Very rare.

HARBINGER.

Tuber.—Round, flattened, dented at heel, numerous, small; *eyes* shallow, generally on point of tuber, *eyebrows* indistinct; *skin* white; *flesh* white.

Sprouts.—Pink.

Foliage.—*Haulm* very **low, spreading;** *stem* pink tinged, colour developing towards maturity, *wing* straight; *leaf* fairly **open, drooping,** some colour in *midrib; leaflets* **light green, very large,** *terminal* overlapped, dull; *secondary leaflets* small, not numerous, rounded.

Flower.—None develops.

Maturity.—First early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes. -Raised by M. Shakeshaft, Lymm, Lancashire. Introduced by Messrs. Sutton & Sons, Reading, 1894. Not grown to any extent. Used only for early forcing in gardens, and occasionally for exhibition.

HERALD.

Tuber.—Oval, frequently tapering to rose end; *eyes* medium to shallow; *eyebrow* distinct, *skin* white, *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* semi-erect, becomes spreading towards maturity; *stems* fairly strong, branching freely, tinge of colour on stem, *wings* narrow, straight, *leaf* fairly close, no colour in *midrib*, *leaflets* fairly large, pointed, dark green, glossy, *young leaflets* **show characteristic pale green colour,** *terminal* generally tied; *secondaries* fairly large, not numerous.

Flower.—White, not numerous; *anthers* yellow, *buds* green with bases slightly bronzed, *sepals* long and narrow, *berries* formed; *flower cluster stalk* fairly short, *flower stalks* long.

Maturity.—Early second early.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight.

General Notes.—Raised and introduced by Messrs. McGill and Smith, Ayr, in 1927-8. Registered by the Scottish Board of Agriculture in 1927. Despite registration, this variety attracted little attention, probably because it was not early enough to replace the well-known non-immune earlies, and was unable to compete in yield with second earlies such as British Queen and Great Scot. Has been successfully used for crossing purposes and seedlings bred from it appear to be of good cooking quality.

HERD LADDIE.

Tuber.—Round to oval, flattened, *eyes* shallow, *eyebrow* present; *skin* deep purple, *flesh* white with a purple ring.

Sprout.—Deep purple.

Foliage.—*Haulm* semi-erect, becomes more or less prone towards maturity, *stems* mottled blue-purple, colour developing in later stages of growth; *wing* straight, *leaf* open, drooping, *midrib* light purple at base and at bases of leaflet stalks; *leaflets* medium green, glossy, narrow, *secondary leaflets* very small, rounded.

Flower.—No flowers open; *buds* not numerous, dark purple, drop readily: *flower cluster stalk* very short, *flower stalks* very short.

Maturity.—Second early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised by W. Kerr, Dumfries. Introduced by Messrs. Dobbie & Co., Edinburgh, about 1908. Never grown to any extent as a commercial variety. It is now of no importance except when occurring as a "rogue" in Edzell Blue.

HIBERNIA.

Tuber.—Oval to long, slightly flattened, regular; *eyes* shallow *eyebrow* distinct, *skin* light purple, darker at rose end, *flesh* yellow.

Sprout.—Deep purple.

Foliage.—*Haulm* tall, upright; deep blue purple practically all over stem, *wing* very wide, slightly waved; *leaf* **long, open,** *midrib* deep purple, with colour carried into leaflet stalks, but only extending slightly into midrib of leaflet; *leaflet* **large,** pointed, fairly dark green; *secondaries* not numerous, small.

Flower.—Blue-purple tips, small, nearly white, **large, very numerous,** *anthers* deep yellow; *buds* deep blue purple, hairy, *sepals* rather short, *hairs* short; *flower cluster stalk* **remarkably long,** bearing flowers high above foliage, *flower stalks* long.

Maturity.—First early.

Disease Resistance.—Susceptible to Wart Disease. Wonderfully free from virus diseases. Rather subject to Blight.

General Notes.—This variety is grown in the Athlone district under the name Gardenfiller, and in County Clare as Land Leaguer. *Yield* good, *quality* excellent, *keeps* **badly.** Origin unknown. Highly favoured in districts where it is known on account of its quality.

IMMUNE ASHLEAF.

Tuber.—Kidney tapering to *heel* and tendency to curve at *heel; eyes* shallow and mostly on point of tuber, *eyebrow* raised on side of tuber, indistinct on point of tuber; *skin* white, *flesh* **yellow.**

Sprout.—Purple.

Foliage.—*Haulm* medium height, semi-erect; only trace of colour on *stems*, *wing* very narrow; *leaf* **open, markedly long,** practically no colour in *midrib; leaflets* **long**, thin and pointed, light to medium green, *terminal* sometimes tied; *leaflet stalks* long, *secondary leaflets* **narrow, pointed, generally pointing upwards.**

Flower.—Pale blue, with merest shade of purple, tipped white, fairly numerous; *anthers* deep yellow, regular; *buds* blue purple, hairs short; *flower cluster stalk* long, carrying flowers well above foliage, *flower stalks* long, deep purple, buds drooping, hairy.

Maturity.—First early, but not among the earliest varieties.

Disease Resistance.—Immune from Wart Disease. Very intolerant of the virus diseases, effects very severe, plants become unrecognisable.

General Notes.—This is the German variety Juli, but it has never become of any commercial importance in Great Britain or Ireland.

IMPERATOR.

Tuber.—Oval, a bit irregular; *eyes* fairly shallow, *eyebrow* indistinct; *skin* white, *flesh* white.

Foliage.—*Haulm* erect, not much colouring on *stem* except in leaf axils, *stem* branching freely above ground, *wing* wide and straight; *leaf* fairly large and open, *midrib* shows faint pink only in young leaves, **with colour distinct in two lines on young leaflet stalks;** *leaflet* fairly large, pointed, light green, hairy, *leaflet stalks* fairly long, bearing secondaries usually pointing upwards; *secondaries* not numerous.

Flower.—Blue-purple, with **large** white tips, small, numerous, colour quickly fades, *anthers* generally pale yellow; *buds* green with purple band and purple lines, hairy; *flower cluster stalk* long and green, *flower stalks* long.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—A German variety raised by William Richter in 1875. Of no value in Great Britain or Ireland.

INCOMER.

Tuber. Flattened round to oblong; *eyes* medium, *eyebrow* indistinct, *skin* white, *flesh* white, slight lemon tinge.

Sprout.—Pink.

Foliage. *Haulm* tall, upright, vigorous; *stems* very strong, branching **freely** below ground, mottled red-purple, *wings* very broad, waved; *leaf* close, no colour in *midrib*, on young leaves two dark lines along midribs and continued on leaflet stalks: *leaflets* medium green, dull, fairly large, cupped; *secondaries* **very numerous, and frequently borne on leaflet stalks,** not large, pointed.

Flower.—White, not numerous, *anthers* pale; *buds* numerous, green with purple markings, drop readily; *berries* sometimes formed.

Maturity.—Late maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight.

General Notes.—Raised and introduced by Chas. Brown, Pitnappie, Newtyle. First tested at East Craigs, Edinburgh, in 1923. *Yield* good, but tubers rather numerous and not large, *quality* fair, *keeps* well. Has not been a commercial success.

INTERNATIONAL KIDNEY.

Tuber. –Kidney; *eyes* very shallow, *eyebrow* noticeable; *skin* white, *flesh* white.

Sprout.—Purple.

Foliage.—Medium height, upright; *stems* mottled blue-purple, developing towards maturity; *leaf* close, faint colouring in mid rib at base of leaflet stalks and at base of leaf; *leaflets* **very dark green,** dull, *edges* waved; *secondaries* large, **markedly round** numerous; *terminals* **frequently tied to first pair of primaries, giving ivy leaf appearance.**

Flower.—White, rare, small, *anthers* pale yellow, malformed; *buds* purple, *flower cluster stalk* short, *flower stalks* short.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease. Very subject to Blight. Tolerant of the virus diseases.

General Notes.—Put on the market by R. Dean, 1879, raiser Robert Fenn, Sulhampstead, Berks. The principal variety grown for forty years in the Channel Islands.

INVERNESS FAVOURITE.

Tuber.—Oval, *eyes* shallow; *skin* white, *flesh* tinged lemon.

Foliage.—*Haulm* erect; *stem* develops considerable amount of colour towards maturity, *wing* decidedly waved; *leaf* close due to number of secondaries, no colour in *midrib*, *leaflets* fairly large, slightly crinkled, dark green, *leaflet stalks* long, frequently bearing secondaries; *secondaries* very numerous, not large.

Flower.—White, not numerous, *anthers* pale and very malformed; *buds* dark greenish purple, hairy, hairs upstanding; *flower cluster stalk* fairly long, *flower stalks* fairly long.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Introduced by Messrs. Sutton & Sons, Reading, in 1928. Tubers too numerous and small.

INVINCIBLE.

Tuber.—Round, somewhat irregular, deep dent at *heel: eyes* deep, *eyebrow* present, *skin* white, often with purple colouring in dent at *heel*, *flesh* **white.**

Sprout.—Purple.

Foliage.—*Haulm* erect, not as much so as Champion; *stems* do not develop as much colour as in the case of Champion, fairly numerous, thicker than Champion; *leaf* fairly close; *leaflets* dark green, *secondaries* more pronounced than in Champion.

Flower.—Blue-purple, lighter shade than Champion, tips white, *anthers* **orange,** well developed; *berries* **numerous.**

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease. Very resistant to Blight. Very free from Leaf Roll.

General Notes.—Raised by Robert Christie, Ballytaggart, Kilraughts, Ballymoney, about 1882. Grown to some extent in Co. Antrim, and at one time sold to Malta as Champion. It, however, gave a better yield than Champion, and became to some extent popularised in Malta.

IRISH CHIEFTAIN.

Tuber.—Oval to long irregular; *eyes* fairly shallow, *eyebrow* distinct; *skin* white with tendency to purple at stem end; *flesh* **white, with a number of brown or black spots.**

Sprout.—Purple.

Foliage.—*Haulm* erect, tall; *stem* develops considerable amount of colour, *wing* crinkled; *leaf* open on account of length of leaflet stalks, faint colour on *midrib; leaflet* **characteristic greyish-green colour and very hairy;** *secondary leaflets* fairly numerous, and frequently have stems.

Flower.—Characteristic light blue-purple, white tipped, very numerous; *buds* green with dark purple markings and hairs very conspicuous; *flower cluster stalk* long, *flower stalks* long, with buds drooping.

Maturity.—Very late.

Disease Resistance.—Immune from Wart Disease. Foliage extremely resistant to Blight, but tubers possess no special degree of resistance. Leaf Roll not observed on crops in the field: intolerant of most of the virus diseases, but is a "carrier" of Virus A.

General Notes. Raised and introduced by McKenna, Manorhamilton, Co. Leitrim, about 1917. *Yield* good, *quality* poor, due to a number of brown spots in the flesh, *keeps* well. Formerly grown to some extent in certain isolated areas in Ireland. Tried extensively in England, but given up. Not now grown commercially.

IRISH QUEEN.

Tuber.—Round, slightly flattened, dented at *heel; eyes* deep, *eyebrow* present, *skin* light pink, *flesh* white.

Sprout.—Deep pink.

Foliage.—*Haulm* erect, tall, vigorous, not much colouring on *stem*; *wing* slightly waved; *leaf* **close and remarkably crowded,** *midrib* shows characteristic **spot** of pink in axil of each leaflet stalk and at base of leaf; *leaflet* **very large, characteristic shade of light green,** slightly crinkled, *young growth* sulphury; *secondaries* fairly numerous, round, well developed.

Flower.—Light purple tipped white, rarely blooms; *anthers* yellow, partly malformed; *buds* not numerous, green with reddish purple stripes; *flower cluster stalk* and *flower stalks* very short.

Maturity.—Maincrop.

Disease Resistance. Immune from Wart Disease. In its earlier years very subject to Black Leg.

General Notes.—This variety was believed to have been raised by Strain, Ballyroney, Co. Down, about 1910, though its origin is somewhat obscure. It was known in the district for a considerable time as "Moss Pink." The name Irish Queen was given to it by the late Isaac Bell, Corbet, Banbridge. *Yield* fair, small number of large tubers, *quality* very good, *keeps* well. This variety was fairly popular in Ireland, but has been superseded by Kerr's Pink.

A variety Irish Strain was put on the market by Strain, Ballyroney, Co. Down, about 1916. It was identical with Irish Queen, except that there was less colour on the tuber.

IRISH WHITE.

Tuber.—Long, irregular, *eyes* very deep, dotted all over tuber, *eyebrows* **very sharp and straight,** *skin* white, *flesh* very pale yellow.

Sprout.—Very light pink at base, tips delicate green.

Foliage.—*Haulm* upright, tall, vigorous; *stems* numerous, some

dark greenish purple colouration, *wing* wide, only slightly waved; *leaf* fairly close, no colour in *midribs*, *leaflets* large dark green, *secondaries* fairly numerous.

Flower.—White, numerous, large number of flowers in each *cluster*, *petals* extra large; *anthers* orange; *buds* **markedly green,** short, plump; *flower cluster stalk* long, *flower stalks* long.

Maturity.—Maincrop.

Disease Resistance. Susceptible to Wart Disease.

General Notes.—Raised by Robert Christie, Ballytaggart, Kilraughts, Ballymoney, about 1882. Prince Albert was one parent. Now grown only in isolated areas in northern counties, chiefly Donegal and Antrim. *Yield* good, *quality* fair, *keeps* extra well, particularly for late use.

JOHN BULL.

Tuber—Round, dented at *heel; eyes* fairly shallow, *eyebrows* long and slightly raised, *skin* white generally **with pink spots,** *flesh* white.

Sprouts.—Pink.

Foliage.—*Haulm* fairly tall, upright; *stems* branching, nearly round, *wings* **very narrow,** *leaf* close, stiff, pointing upwards, comes off stem at small angle, *leaflet* stalks long, *leaflet* medium green, cupped, *veins* not prominent; *secondaries* numerous. **There is usually a pair of secondaries attached to the midrib almost at the same point as the first pair of primaries.** (See Beauty of Bute).

Flower.—Red purple tipped white. *Buds* dark red purple.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—More bushy than B. of Bute, but in some respects bears a close resemblance to it. Origin unknown. Not grown commercially. Occurs only as a "rogue."

KATIE GLOVER.

Tuber.—Flattened oval; *eyes* shallow, *eyebrow* distinct, *skin* practically white, faint trace of yellowness, with splashes of light pink and deeper pink in eyes; *flesh* white.

Sprouts.—Pink.

Foliage.—*Haulm* **very low, spreading, bushy, compact appearance;** colour develops to some extent on *stems* towards maturity; *stems* branching and numerous; *leaf* fairly open, drooping, *midrib* shows no colour. *leaflets* fairly large, medium green, **glossy,** thin; *secondaries* not well developed, pointed.

Flower. –Never blooms; *buds* deep reddish purple and hairy, **close, clustered, due to very short** *flower stalks; flower cluster stalk* short, coloured, sometimes bears leaves.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Put on the market by A. Findlay in 1921. *Yield* poor, *quality* fair, *keeping quality* medium. This variety was not a commercial success.

KEAY'S CHAMPION.

Tuber.—Oval, slightly dented at *heel; eyes* medium to shallow, *skin* white, mottled pink, especially at heel end; *flesh* pale lemon.

Sprouts.—Pink.

Foliage.—*Haulm* semi-erect; *stems* numerous, only slightly mottled reddish purple, *wings* broad and straight; *leaf* rigid. *midrib* tinged reddish purple, *leaflets* **rounded, light green, dull,** small; *secondaries* light green, round, fairly large and numerous.

Flower.—White, numerous; *anthers* orange, *buds* green, *sepals* long.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised by F. W. Keay. Tested at Ormskirk, 1923. Introduced by Garden Supplies, Ltd., Liverpool, in 1925. Tubers a bit rough, and generally showed much cracking.

KEPPLESTONE KIDNEY.

Tuber.—Oval, elongated; *eyes* shallow, often with raised *eyebrows*, skin blue-purple, *flesh* yellow.

Sprout.—Purple.

Foliage.—*Haulm* tall, upright; *stem* deeply coloured; *leaf* open, short, *midrib* deeply coloured, blue purple, *leaflets* dull; *secondaries* pointed.

Flower.—White, large, numerous; *anthers* deep yellow, normal; *buds* dark blue-purple; *berries* frequent.

Maturity.—Early maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Never grown to any extent.

KERR'S PINK.

Tuber.—Round, slightly flattened, dented at *heel;* eyes medium to deep, *eyebrows* distinct, *skin* light pink, generally deeper in colour towards rose end, *flesh* white.

Sprout.—Deep pink.

Foliage.—*Haulm* tall, upright, very vigorous; *stem* thick, strong, not usually numerous, tinged reddish purple, develop more colour as they become older; *wings* crinkled; *leaf* fairly large, inclined to be rigid, fairly close, *midrib* reddish purple with colour most pronounced at base of leaf and base of leaflet stalks; *leaflets* dark, showing trace of greyish green, large, pointed; *secondaries* large and often borne on leaflet stalks; *terminal leaflet* sometimes tied; there is practically always a well-developed pair of secondary leaflets between the terminal and the first pair of primaries, and sometimes a second smaller pair of secondaries.

Flower.—White, fairly numerous; *anthers* yellow, regular; *buds* dark reddish-purple; *flower cluster stalk* medium length. *flower stalks* short, carrying buds either erect or horizontal, never decidedly drooping as is the case in several " rogues " found in this variety. *Berries* do not occur.

Maturity.—Maincrop, on the late side.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight. Leaf Roll effects very severe. Tolerant of most of the virus diseases, but Virus B. causes Top Necrosis and Virus D. causes Foliar Necrosis. Occasionally affected by Dry Rot in storage. Subject to Skin Spot.

General Notes.—Raised by James Henry of Ottawa, late of Brae, Cornhill, Banffshire, in 1907. Originally called Henry's Seedling, and also known as Brae Seedling. Sent by Mr. Kerr, Banff, to Ormskirk, 1916. Awarded a Lord Derby Gold Medal in Ormskirk Trials, 1916. First Medal awarded. It rapidly came into prominence. In 1929 this variety occupied 39,097 acres out of 123,358 acres grown in Scotland, and showed no appreciable reduction until 1935. It is also very popular in all parts of Ireland. Popular in many English markets, but not much grown in England except in Lancashire. *Yield* very good, *quality* very good, *keeps* fairly well. The best maincrop variety that has come on the market since the advent of Arran Chief.

It is rather remarkable that when it was introduced there was a very large number of "rogues" in practically all stocks of this variety. The great majority of the "rogues" were varieties with round pink tubers, which rendered them difficult to remove except during growth.

Some of the " rogues " found have never been named, but are called by some outstanding characteristic such as the " Green-budded Rogue." The principal rogues with pink tubers are:— Yam, Gregor Cups, " Rogue like Great Scot," Irish Queen, Shamrock, Flourball, Red Potato, Lord Roseberry, Peach Bloom, Reading Russet, " Green-budded Rogue," " Open-leafed Rogue," Waverley, Cardinal, Raeburn's Gregor Cap, Maud Meg, Sharp's Pink Seedling.

The most striking characteristics by which these varieties can be distinguished from Kerr's Pink are:—

Yam.—*Leaf* more open, longer, more drooping, and **colour much more pronounced in midrib** and **on stem.** *Anthers* orange, *buds* show less colour, *tuber* yellowish pink, *flesh* **yellow.**

Gregor Cups.—*Wing* on stem very crinkled, zig-zag appearance of *stem*, *leaflets* grey-green, crinkled; practically never blooms; *flower buds* very dark red purple, drop readily.

"Rogue like Great Scot."—The foliage of this variety in its early stages resembles Great Scot, except that it shows reddish purple colour more clearly in midrib of leaf and on stem; *foliage* shows less colour than Kerr's Pink; *flowers* **more numerous in flower cluster,** *petals* **larger than Kerr's Pink;** *anthers* **orange,** *berries* **formed.**

Shamrock.—Hard dark green colour of foliage, grows much later *Skin* of tubers all uniform deep pink. A common mixture in some districts in Ireland.

Flourball.—*Skin* of tuber all uniform deep pink; *foliage* darker green, *petals* larger.

Red Potato.—*Tuber* flattened oval, *flesh* streaked pink; *berries* formed. Rarely occurs.

Reading Russett.—Medium height, *leaflets* very large; *anthers* orange; *berries* formed freely. Not a common "rogue."

"Green-budded Rogue."—*Flower buds* **green.** *Flower cluster stalk and flower stalks* **green.** Not a common "rogue."

Waverley.—*Flower* seldom formed, *tuber* **long, oval,** *buds* pink. Rarely occurs as a " rogue."

(All the foregoing have white flowers.)

Irish Queen.—Flower light red-purple, rarely blooms. Characteristic pale green colour of *foliage*, crowded *leaf*. A very common "rogue" among Kerr's Pink in some districts of Ireland.

Lord Roseberry.—Flowers numerous, red-purple, low-growing, *skin* of tuber deep pink. Does not occur frequently.

Peach Bloom.—Flowers numerous, dark red-purple; *anthers* separate widely apart when flower opens; *skin* bright pink. Very rarely occurs.

Cardinal.—*Flowers* red-purple, with white tips, *skin* deep red, *kidney* tuber. Rarely occurs as a "rogue.":

Raeburn's Gregor Cups.—*Flower* pale red-purple with large tips of white, numerous, *secondaries* very inconspicuous. Rarely occurs at the present time.

Maud Meg.—*Flower* red-purple, *tuber* bright pink, *flesh* **yellow.** Rarely occurs as a rogue.

Sharpe's Pink Seedling.—*Flower* **red-purple.** Rarely occurs as a rogue.

Kerr's Pink tubers have been secured showing a white skin; also tubers with purple skin, but otherwise true to type; and tuber portion purple and portion pink. Rogues are now (1937) much fewer in crops of Kerr's Pink that was the case some years ago.

KING EDWARD VII.

Tuber.—Oval; *eyes* very shallow and mostly on point of tuber, *eyebrow* indistinct; *skin* **white with pink splashes of varying size;** *flesh* white. **Red King** has *skin* deep pink, *tuber* otherwise resembles King Edward.

Sprout.—Pink.

Foliage.—*Haulm* upright, tall, moderately vigorous; *stems* somewhat bare, branching freely, reddish purple tinge; *leaf* fairly close, not large, *midrib* shows slight markings at base and at base of leaflet stalks; *leaflets* medium to dark green, small, narrow, glossy, pointed, *edges* waved, *secondaries* numerous, pointed, not large.

Flower.—Dark reddish-purple tipped white, rarely blooms; *anthers* pale yellow, malformed; *buds* small, deep reddish purple, hairy; *flower cluster stalk* short, always borne from top of stem, *flower stalks* short, deeply coloured.

Maturity.—Maincrop, almost an early maincrop.

Disease Resistance.—Susceptible to Wart Disease. Now subject to Blight. Leaf Roll very rare in good seed stocks, but its effects on the variety are very severe; very tolerant of most viruses, probably more so than any variety except Great Scot, but Virus X causes Top Necrosis. Resistant to Common Scab.

General Notes.—According to Salaman, this variety was raised by a gardener in Northumberland, who named it Fellside Hero. From Northumberland it passed into the possession of a grower in Snaith, Yorks, who brought it to the notice of a Manchester potato merchant. The latter could make no immediate use of it, and gave his tubers to Mr. J. Butler, Scotter, who eventually bought all the stocks that were in the hands of the Yorkshire grower. Mr. Butler grew on until he had 50 acres of the variety in hand. On the advice of a Mr. Paxten, potato merchant, Manchester, he renamed the variety King Edward, and placed his stocks on the market in 1902 at £12 10s. per ton. It became, and still remains, the most popular variety in England, particularly with consumers. The cause of its popularity is ascribed by some to the fact that it is a waxy potato, and will not absorb much fat when cooked in certain ways, while others ascribe its popularity to the fact that on account of the colour of its skin it can be readily identified; others say that no matter how long the tubers may be in boiling water they will remain intact.

Bolters and **Wildings** occur. *Yield* poor in many districts. Never popular in Ireland or Scotland. Grown very extensively in Lincolnshire.

Red King has definite red spot in axil of leaflet stalk, very indefinite if present at all in King Edward. Foliage of Red King otherwise resembles King Edward. Red King is only a sport from King Edward. Another sport has purple splashes.

KING GEORGE V.

Tuber.—Oval to long, a bit irregular; *eyes* shallow; *eyebrow* present; *skin* white, *flesh* white.

Sprout.—Pink, a brighter and deeper pink than British Queen, but not so deep as Great Scot.

Foliage.—Haulm spreading, medium height; *stems* branching, tinged reddish purple, *wing* slightly waved near top of stems; *leaf* fairly open, long, drooping; *leaflet* **rather light green,** smaller than British Queen, dull; *secondaries* pretty well developed, numerous. More pointed than in British Queen.

Flower.—White, numerous, but not so numerous as British Queen, **small;** *anthers* **sometimes pale and malformed,** *buds* dark greenish purple, scarcely as dark as British Queen; *flower cluster stalk* long, carrying flowers well above foliage, bronzed, *flower stalks* not as long as British Queen, in consequence buds not drooping to the same extent.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raiser not known. Introduced in 1911 by John Butler, Scotter, who obtained it from James Gardiner, Perth. *Yield* very good, *quality* poor, *keeps* well. Grown to a considerable extent in Great Britain during the war years, but was given up later chiefly on account of quality. Never grown to any extent in Ireland. Of no commercial importance now.

K. OF K.

Tuber.—Round to long, mainly round: *eyes* shallow, *eyebrow* present: *skin* **pale yellow with considerable amount of pink, particularly about eyes and rose end;** *flesh* pale lemon, soft.

Sprout.—Pink.

Foliage.—*Haulm* erect; *stems* thin, bare and spindly, pink tinge developing towards maturity, *wings* markedly crinkled; *leaf* open, *midrib* frequently coloured; *leaflets* **small yellowish green;** *young growth* sulphury; *secondaries* fairly numerous, pointed often occurring on leaflet stalks.

Flower.—Light red-purple tipped white; not numerous, *sepals* green, long and pointed; *buds* **markedly bright reddish purple, green tips;** *flower cluster stalk* short, deeply coloured; *flower stalks* very short.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised and introduced by the late A. Findlay, Auchtermuchty. Tested first at Ormskirk in 1919. *Yield* poor, too many small tubers, *quality* medium, *keeps* moderately well. Always showed lack of vigour.

LEINSTER WONDER.

Tuber.—Round, slightly flattened, deep dent at *heel*, *eyes* medium to deep, *eyebrow* distinct: *skin* white **with distinct pink tinge,** very pronounced in some cases, particularly at heel end when exposed to light; *flesh* white.

Sprout.—Deep pink.

Foliage.—*Haulm* very tall, erect; *stems* thin, considerable amount of colour develops: *wing* broad and straight, *leaf* stiff, erect, **markedly open,** *midrib* shows no colouring except two dark lines on young leaves and leaflet stalks due to deep groove, dis

appearing later; *leaflets* dark green, hard appearance, resembling Shamrock, medium size; *leaflet stalks* very long, often bearing well-developed secondaries; *secondaries* fairly large, pointed, fairly numerous.

Flower.—White, numerous; *anthers* deep yellow, regular; *flower cluster stalk* long; *flower stalk* long. *Berries* freely formed.

Maturity.—Late maincrop.

Disease Resistance.—Immune from Wart Disease. Very resistant to Blight. Not tolerant of the virus diseases.

General Notes.—Raised by Miss Williams, Killucan, Co. Westmeath, about 1905, and introduced by J. F. Williamson, Summerhill, Mallow, Co. Cork, in 1910. *Yield* light, *quality* excellent, *keeps* well. Grown for several years to some extent in southern and midland counties of Ireland, but could not be called a commercial success.

LOCHAR.

Tuber.—Round to oval, not uniform; *eyes* medium to shallow, *eyebrow* present; *skin* generally regarded as white, though there is always a **distinct light pink tinge present,** particularly noticeable when immature, colour is most pronounced in *eyes* and *heel*; *flesh* white.

Sprout.—Pink.

Foliage.—Haulm semi-erect, medium height; *stems* numerous, branching, pink tinge on *stem*, with colour pronounced in *leaf axils*, *leaf* rigid **with characteristic crowded appearance** due to the large number of *secondary leaflets*, no commercial variety except Sharpe's Express, has nearly so many *secondaries*, no colour in *midrib; leaflets* small, rounded, **characteristic shade of light green,** crinkled; *secondaries* very numerous, fairly well developed.

Flower.—White, rarely blooms; *anthers* pale yellow, malformed; *buds* **markedly green,** drop readily; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight.

General Notes.—Raised and introduced by the late W. R. Farish, Dumfries, in 1915. Awarded a Lord Derby Gold Medal in Ormskirk Trials, 1916. *Yield* very good, *quality* extremely poor, *keeps* remarkably well. This variety was extensively grown for some years where Wart Disease existed, but became practically unsaleable on account of its quality. When boiled the flesh of the tubers in a very short time becomes very dark coloured. Variety not now grown (1937).

LONDON BLUE.

Tuber.—Round, *eyes* deep, *skin* bluish purple with deeper colour in eyes.

Sprout.—Purple.

Foliage.—*Haulm* erect, very tall, vigorous; *stem* deeply coloured blue-purple, *leaf* close, *midrib* coloured deep blue purple, *leaflet* rounded, crinkled.

Flower.—No bloom seen.

Maturity.—Second early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Very old variety, procured in Co. Donegal.

LORD ROSEBERRY.

Tuber.—Round, eyes medium to shallow, *eyebrow* pronounced, *skin* deep pink, *flesh* white.

Sprouts.—Deep pink.

Foliage.—*Haulm* medium height, spreading; *stem* branching, mottled red-purple; *leaf* open, *midrib* red purple, colour most pronounced at base and at bases of leaflet stalks; *leaflets* long, medium to dark green, glossy, *leaflet stalks* fairly long, occasionally bearing secondaries; *secondaries* numerous, small, pointed

Flower.—Characteristic deep red-purple, white tips, large, sometimes numerous; *anthers* yellow, often deformed, and **sometimes petal like;** *buds* dark red purple, **sometimes clustered;** *flower cluster stalk* very long, *flower stalks* sometimes very short, with green leaves, deeply coloured.

Maturity.—Second early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Occurs as a rogue in some stocks of Kerr's Pink. Of no commercial importance.

LORD TENNYSON.

Tuber. Round *eyes* deep, *skin* white with purple blotches; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* semi-erect; *stem* shows a consi lerable amount of purple colour; *wing* straight; *leaf* fairly close; *midrib* shows colour at base and at base of leaflet stalks; *leaflets* light green, yellow mottling frequently present.

Flower.—Purple, numerous..

Maturity.—Maincrop.

Disease Resistance. Immune from Wart Disease.

General Notes.—Passed its second year's test for immunity from Wart Disease at Ormskirk, 1924. Of no commercial importance.

LUMPER.

Tuber.—Round to long, somewhat flattened, very irregular, *eyes* deep and dotted all over tuber, *eyebrow* very indistinct and sunken; *skin* white, *flesh* **distinctly lemon.** See figure 75.

Sprout.—Faint pink at base. Very late in sprouting.

Foliage.—*Haulm* erect, medium height; *stems* thin, fairly numerous, no purple colouring, *wing* slightly crinkled; *leaf* open, *midrib* characteristically **pale green;** *leaflets* pale green, margins waved, medium size, *midrib of leaflet* very pronounced; *secondaries* small, rounded.

Flower. White, rare; *buds* **green,** drop off readily; *anthers* pale, malformed; *flower cluster stalk* fairly long, green; *flower stalks* short.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Tolerant of the virus diseases.

General Notes.—Very old variety, true stock obtained only from Dingle. Grown very extensively, as early as 1810, and continued to be the "poor man's potato" until 1846, when its failure due to Blight caused the Famine.

LYMN GREY.

Tuber.—Round to flattened round, *eyes* medium depth, cup-shaped, *eyebrows* show only on eyes on side of tuber, and not on rose end; skin inclined to be yellow, netting pretty general, **frequently pink colouration at heel end particularly noticeable in immature state;** *flesh* tinged lemon, firm, hard in cutting.

Sprout.—Pink.

Foliage.—*Haulm* semi-erect, medium height, young plants have bushy appearance; *stems* tinged reddish purple, *wings* **have large waves;** *leaf* slightly drooping; *upper surface of leaf stalk* **adjacent to stem is flat, whereas in Great Scot there is a distinct groove;** *midrib* shows colour very distinct at base of leaf stalk and at base of leaflet stalks, particularly on the younger leaves, *leaf* fairly open; *leaflets* **light greyish-green,** thick, **hairy,** narrow, **pointed;** *secondary leaflets* fairly numerous, **between terminal leaflet and first pair of primary leaflets secondaries are very small or entirely absent whereas in Great Scot, a fairly well-developed pair of secondaries is always present.**

Flower.—Pale red-purple, tipped white, seldom blooms; *flower buds* numerous, drooping readily, green at base and tips with purple band intervening, not as dark coloured as Great Scot; *flower cluster stalk* short; *flower stalk* fairly short, buds being carried horizontally or slightly drooping.

Date of Maturity.—Second early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Old variety, of no commercial importance, except in so far as it occurs as a "rogue," particularly amongst immunes. Frequently present in stocks of Great Scot. Produces a large number of small tubers.

MAGNUM BONUM.

Tuber.—Oval to long, sometimes tapering to both ends, *eyes* shallow and mostly on point of tuber, *eyebrow* indistinct; *skin* white, *flesh* white.

Sprout.—Faint pink at base, white tip.

Foliage.—*Haulm* tall, erect, branching fairly freely, vigorous; *stem* shows considerable amount of reddish purple colour, *wing* waved; *leaf* open, fairly large, *midrib* shows reddish purple markings in axil of leaflet stalk, and at base of leaf; *leaflets* light to medium green, fairly large; *mosaic mottling* frequently present; *secondaries* rather small, not numerous, rounded.

Flower.—Light, red-purple, tipped white, fairly numerous, *anthers* generally malformed, *style* long; *buds* dark purple with green bases and tips, hairy; *flower cluster stalk* long, generally coming from axil in lower leaf, does not rise much above foliage, not much colour; *flower stalks* not so long as Up-to-date, buds slightly drooping.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised by the late James Clarke, Christchurch, Hants., introduced by Messrs. Sutton & Sons, Reading, 1876. At one time the most popular variety in England, but did not make much headway in Ireland on account of the Champion being so extensively grown. The variety is only found as a "rogue" in certain districts, chiefly among Up-to-dates.

MAINCROP (Langworthy) and GOLDEN WONDER.

Tuber.—Kidney, somewhat irregular, frequently pointed and twisted, *eyes* shallow, *eyebrow* indistinct, *skin* white, russet in the case of Golden Wonder, *flesh* pale lemon.

Sprout.—Purple.

Foliage.—*Haulm* tall, erect; *stems* show only trace of colour in leaf axils, branching freely, *wing* **broad,** generally straight but sometimes waved; *leaf* fairly open, ridged between veins, no colour in *midrib*, young growth sulphury; *leaflets* **crinkled,** medium green; *secondary leaflets* small, not numerous, *terminal* not overlapped; *terminal* has rounded appearance.

Flower.—Light bluish purple, with very large white tips, in comparison with the size of the flower; fairly numerous, *anthers* yellow, regular; *buds* **markedly green base,** remainder green with dark bluish purple markings; *flower cluster stalk* fairly long frequently bearing a leaf, *flower stalks* short, giving flower buds a compact appearance.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Foliage shows only slight resistance to Blight, but tubers fairly resistant. Leaf Roll effects severe. Not tolerant of the virus diseases. Virus causes Foliar Necrosis. Resistant to Common Scab.

General Notes.—Raised by James Clarke, Christchurch, Hants, about 1876. Renamed Langworthy by the late J. Niven, Perth, about 1900. This variety was about 1906 fairly extensively grown in Scotland. It was noted for its extra good *cooking* and *keeping qualities*, *yield* rather light. Never grown to the same extent in England or Ireland. **Golden Wonder** is identical with **Maincrop,** except that it has a russet skin and can in consequence be readily identified. Golden Wonder was put on the market by John Brown, Peashill Farm, Arbroath, in 1904, and was exhibited at the Crystal Palace Show that year. This variety sells in Edinburgh and Glasgow markets at substantially higher prices than any other variety on account of its superb quality. *Quality* superb, *keeps* extra well. Stocks practically free from Mosaic, have been raised, and such stocks produce fair yields. Golden Wonder is admittedly the highest quality variety in existence.

MAJESTIC.

Tuber.—Kidney frequently tapering towards *heel; eyes* very shallow, *eyebrow* present, *skin* white, *flesh* white.

Sprout.—Very light pink; delicate, weak sprout, easily broken off.

Foliage.—*Haulm* spreading, medium height, not nearly so close and compact as British Queen; *stem* shows practically no purple colouring; *leaf* open, flat, **distinct reddish purple colour in** *midrib* **of young leaves only, with colour continued on leaflet stalks and well into midrib of leaflet;** *leaflets* pointed, light green tending towards grey green; *young growth* on top of plant sulphury, *secondaries* small, fairly numerous.

Flower.—White, fairly numerous; *anthers* orange, deeper colour than British Queen, regular; *buds* very dark reddish purple base, with green tips, numerous; *flower cluster stalk* long, not so dark coloured as British Queen; *flower stalks* long, coloured. *Berries* frequently formed.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease. Shows much more than ordinary resistance to Blight; Leaf Roll effects fairly severe; rather subject to Dry Rot in some seasons; intolerant of several of the virus diseases, Virus Y produces Leaf Drop Streak, and Virus D produces Top Necrosis, but this variety is a "carrier" of Virus B. Very subject to Common Scab.

General Notes.—Yield good, *quality* fair, *keeps* fairly well, except when tuber is injured. The most popular maincrop variety in England at present. Not popular in Ireland or Scotland, grown only for sale as seed. *Sets* very liable to fail to produce a plant. Raised and put on the market by A. Findlay, Auchtermuchty, in 1911.

MARQUIS OF BUTE.

Tuber.—Round, *eyes* moderately deep, *skin* white, thin, with distinct pink in eyes, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* medium height, markedly spreading, *young growth* sulphury; *stems* strong, *wings* broad, very slightly waved; *leaf* **close,** due to short internodes and well-developed secondaries; colour in *midrib* shows only trace at base of leaf and base of leaflet stalks; *leaflets* **large, dark green,** rounded, **thin,** glossy, arched, an occasional *terminal* tied; *secondaries* large and glossy.

Flower.—White, not numerous; *anthers* yellow, normal; *buds* markedly green, fairly numerous; *flower cluster stalk short; flower stalks* short green.

Maturity.—Late second early.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Introduced by J. L. Clucas, Ormskirk, 1921. Selected from stock of Ally. Of no commercial value, but is found as a "rogue" in stocks of Ally.

MAY QUEEN.

Tuber.—Kidney, long, irregular; *eyes* very shallow; *eyebrow* present; *skin* white, *flesh* white, soft.

Sprout.—Purple.

Foliage.—*Haulm* very vigorous, spreading, medium height; *stem* shows trace of purple colour, *wings* crinkled; *leaf* fairly close, large, long, *young growth* not sulphury (see Arran Pilot), more glossy than Pilot; *leaflets* **very large,** pointed, glossy, *margins of leaflets* **frequently waved,** *terminal* generally overlapped, *secondaries* not numerous, small.

Flower.—Bluish-purple, with large white tips, numerous, fairly large number in flower cluster; *petals* large, *number of petals* irregular; *buds* purple, hairy, drooping, numerous, large; *flower cluster stalk* long; *flower stalk* fairly long.

Maturity.—One of the earliest.

Disease Resistance.—Susceptible to Wart Disease. Subject to Blight. Very subject to Dry Rot during storage.

General Notes.—*Yield* good; *quality* fair; *keeps* badly. Fancied for early forcing in gardens. Raised by Walker (a small market gardener), Bishop's Cleeve, near Cheltenham, before 1890, and known as Walker's Seedling. Put on the market as May Queen by Messrs. Sutton & Sons in 1900.

MEIN'S EARLY ROUND.

Tuber.—Round, very slightly flattened, shallow; dent at *heel; eyes* shallow and generally pink, *eyebrows* distinct, curved, *skin* white except for pink colour in eyes; *flesh* white.

Sprout.—Decidedly pink, fairly strong; *hairs* very numerous over sprout from base to tip, upstanding.

Foliage. - *Haulm* semi-erect, *stem* shows fair amount of colour, *wing* narrow and straight; *leaf* close, due to numerous secondaries, erect, practically no colour in *midrib*, *leaflets* dark green glossy, cupped; *secondaries* numerous, round, not large.

Flower.—Not observed. *Buds* numerous, purple markings, hairy, drop readily; *flower cluster stalk* short, *flower stalks* short, coloured.

Maturity.—Second early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Grown only as an exhibition variety.

MERRICK'S.

Tuber.—Round, irregular, deep dent at *heel; eyes* deep, *eyebrow* present; *skin* white with violet colour in eyes and light purple blotches scattered over tuber; *flesh* yellow. Tuber resembles Buchan Beauty, but colour always pronounced in eyes.

Sprout.—Deep purple.

Foliage.—*Haulm* erect; *stem* mottled blue-purple, **particularly at the nodes,** branching freely; *leaf* decidedly open, long; *midrib* blue purple, with colour very pronounced at base and bases of leaflet stalks, colour carried into *leaflet stalks* and well into *midrib of leaflets; leaflets* large, *margins* waved; *secondaries* small, rounded.

Flower.—Blue-purple, white-tipped, not numerous, *flower buds* deep purple base, green-tipped, numerous, frequently drop before opening; *flower cluster stalk* coloured, fairly long; *flower stalks* deeply coloured, short.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Very intolerant of the virus diseases; plants becoming unrecognisable.

General Notes.—An old variety procured in Co. Galway. Now found only as a mixture among other varieties in very rare cases.

MILLER'S BEAUTY.

Tuber.—Oval to long; *eyes* shallow, *eyebrow* distinct and long; *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* tall, upright, later becoming prone; *stems* thick, *wings* broad, slight waving, small amount of sulphury colour on young foliage; *leaf* fairly close, slightly drooping, no colouring in *midrib; leaflet* **large, dark, green, glossy;** *secondaries* **rounded, large.**

Flower.—None; *buds* numerous green, with distinct pink markings; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised and introduced by D. Millar, West Calder, Midlothian. Not a commercial success. Sent to Ormskirk for trial in 1920.

MILL STREET HERO.

Tuber.—Round; *eyes* shallow, *eyebrow* distinct; *skin* light purple, colour more pronounced in *eyes*, particularly about rose end, thin; *flesh* white.

Sprout.—Deep bluish purple, almost violet, strong.

Foliage.—*Haulm* semi-erect; *stem* mottled purple, with colour developing towards maturity; *leaf* fairly close, *midribs* faintly coloured, except at base and in axils of leaflet stalks, where colour is pronounced; on young *leaves* midrib shows two purple lines, which pass into leaflet stalks; *leaflets* medium size, **dark green,** glossy; *secondaries* fairly numerous, pointed.

Flower.—White, only an occasional flower; *buds* fairly numerous, drop readily, small and green, with dark purple band and lines; *flower cluster stalk* medium; *flower* stalks short, coloured.

Maturity.—Second early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—This variety was grown on a very small scale in the Ards district, Co. Down. *Tubers* numerous, small: *quality* good. No commercial value.

MR. BRESEE.

Tuber.—Oval to long, very uniform; *eyes* very shallow; *eyebrow* indistinct; *skin* bright pink; *flesh* white, with a considerable amount of pink streaking.

Sprout.—Deep pink.

Foliage.—*Haulm* low to medium height, spreading; *stem* branching, tinged red-purple, colour develops as plant ripens: *wings* slightly waved; *leaf* markedly open, *midrib* red-purple, most pronounced at bases of leaflet stalks and at base of leaf; *leaflets* **light green,** pointed, *edges* waved, *secondaries* small, pointed.

Flower.—White, rare; *anthers* malformed, very pale; *buds* numerous, purple base, green tips; *sepals* long, conspicuous; *berries* round, very rare and then without seed: *flower cluster stalk* fairly long, coloured, *flower stalks* deeply coloured, short, thin, carrying buds horizontal or drooping.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease. Intolerant of the virus diseases, plants becoming very stunted.

General Notes.—Raised and introduced by the late Mr. Bresee, of Habbardson, Vermont, U.S.A. *Yield* poor, *quality* extremely bad, *keeps* badly. Useful only as an exhibition variety, for which its shape and colour are excellent.

MYATT'S ASHLEAF.

Tuber.—Kidney, generally tapering to *heel;* somewhat flattened; *eyes* very shallow and mostly on point of tuber, *eyebrows* swollen and very pronounced on eyes at side of tuber; *skin* very pale yellow, slightly russet; *flesh* **pale yellow.**

Sprout.—Purple.

Foliage.—*Haulm* medium height, semi-erect, later becoming prone, probably due to effects of Mosaic Disease; *wing* straight, blue-purple colour well developed in *stems; leaf* open, *short* and rigid, blue purple on *midrib* at base and at bases of leaflet stalks: *leaflet* small, dark green, glossy, **the edges of the leaflets turn upwards.** secondaries small and numerous.

Flower.—Apparently blue, tipped white, numerous; *anthers* orange, regular; *buds* dark blue purple; *flower cluster stalk* dark coloured, fairly long, *flower stalks* long, buds drooping; *berries* **very numerous.**

Maturity.—Early second early.

Disease Resistance.—Susceptible to Wart Disease. Now very subject to Blight.

General Notes.—A very old variety. Raised by James Myatt, Offenham, Evesham, Worcestershire, about 1853. *Yield* light, *quality* very good, *keeps* fairly well. Almost gone out of cultivation.

NEW ERA.

Tuber.—Oval to round, flattened; *eyes* shallow, *eyebrow* present, *skin* white, *flesh* white.

Sprout.—Pale pink at base, white tip.

Foliage.—*Haulm* tall, upright; *stems* have bare appearance, practically no colour, *wing* markedly crinkled; *leaf* open, small, *midrib* shows no colouring except trace at base; *leaflets* long, narrow, crinkled, pointed, hairy, tending to greyish green; *secondaries* small and rounded.

Flower. -Light reddish purple, white tips; only a rare single flower produced; *buds* numerous, drop readily, light reddish-purple, hairy; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—This variety was procured at Greyabbey, Co. Down, in 1918, and was believed to have been recently introduced from New Zealand. On acount of its being non-immune, it never assumed any commercial importance.

NINETYFOLD.

Tuber.—Long, oval rather irregular; *eyes* shallow and mostly on point of tuber; *eyebrow* distinct; *skin* white; *flesh* snow-white and soft.

Sprout.—Pink.

Foliage.—*Haulm* medium height, spreading; *stem* shows little colour, except slightly tinged reddish purple towards maturity; *stem* branching; *wing* waved; *leaf* open, *leaflet* medium green, fairly large, glossy; *secondary leaflets* not numerous, rounded, small.

Flower.—White, practically never blooms, *anthers* generally pale yellow and malformed; *buds* reddish purple; *sepals* long.

Date of Maturity.—One of the earliest varieties in cultivation.

Disease Resistance.—Susceptible to Wart Disease. Very subject to Blight. Withstands Leaf Roll and the virus diseases better than any early except Epicure; seed tubers in boxes very liable to Dry Rot, one of the worst varieties in this respect; Aucuba Mosaic always present, but apparently causes no damage.

General Notes.—*Yield* good, *quality* medium; *keeps* badly; a popular early variety in Lancashire, Cheshire, and Bedfordshire. Raised by James Clark, Christchurch, Hants, and introduced by Messrs. Sutton & Sons, 1897.

NITHSDALE.

Tuber.—Kidney, tapering to rose end, *eyes* shallow, *eyebrow* indistinct, *skin* white, *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* semi-erect, medium height; *stem* mottled blue-purple towards maturity, colour very pronounced at base, where it is nearly purple, *wing* straight; *leaf* **open, very few leaflets, usually a terminal, and one or two pairs of primaries,** especially on the lower leaves; *leaflets* large, especially terminals, pointed and fairly glossy, light green.

Flower.—White, not numerous; *anthers* yellow, regular; *buds* **green,** *flower cluster stalk* not long, but arises from top of main stem, and so carries flowers well above foliage, *flower stalks* not long.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised by Mair, Mickleholme, Lockerbie, 1912. Introduced by A. W. McAlister, Dumfries, about 1916. Of no commercial value. Tubers numerous and too small.

NORTHERN STAR.

Tuber.—Round, somewhat flattened, *eyes* shallow, *eyebrow* present; *skin* white, with **small pink spots in eyes**, particularly on immature tubers, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* upright, **bushy, compact appearance;** *stems* branching freely, *wing* slightly waved, *stems* show slight pink colouration towards maturity; *leaf* **close, due to short internodes, rigid,** in *young leaves* pink colour distinct in axils of leaflet stalks and in axil of leaf, disappears later; *leaflet* **dark greyish green, small, narrow pointed;** *secondaries* small, **not numerous.**

Flower.—White, small, very rare; *anthers* pale yellow, malformed; *buds* **markedly green,** *hairy*, small; *flower cluster stalk* short, *flower stalks* short, green.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease. Fairly resistant to Blight; tolerant of the virus diseases.

General Notes.—Raised and introduced by A. Findlay, 1900. One of the varieties made famous in the "potato boom." Of no commercial value. *Yield* moderate, an extremely large number of small tubers, hence it is a very persistent rogue. Occurred as a rogue mostly among Arran Chief and Lochar.

OPEN-LEAFED ROGUE FROM KERR'S PINK.

Tuber.—Flattened round, small dent at *heel; eyes* shallow, more so than Kerr's Pink, *eyebrow* indistinct; *skin* light pink, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* erect: some dark reddish purple colour on stem, not nearly so much as Kerr's Pink, *stems* a bit bare, *wing* straight, *leaf* **markedly open, rigid;** only trace of colour in *midrib*, *terminal* drooping slightly; *leaflet* light green, fairly long and pointed, *secondaries* small, decidedly pointed, and curved upwards.

Flower.—Not observed. *Buds* fairly numerous, light reddish purple, *flower cluster stalk* short and thin, *flower* stalks short.

Maturity.—Maincrop.

Disease Resistance.—Immunity not known.

General Notes.—Name unknown. Occurs as a rogue amongst Kerr's Pink. Rarely found. Got in stock from Banffshire.

ORANGE ANTHER SUBSTITUTE FOR KERR'S PINK.

Tuber.—Round, dent at *heel*, *eyes* medium to deep, *eyebrow* distinct, *skin* pale pink, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* tall, vigorous: *stem* tinged pink, thick, and strong, *leaf* rigid, fairly close: *leaflets* **glossy,** medium green.

Flower.—*White*, numerous, *anthers* **orange;** *buds* dark red purple, an occasional *berry*.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Rogue found in some stocks of Kerr's Pink, and was sold as Kerr's Pink.

ORMSBY CHOICE.

Tuber.—Round, shortest axis from rose end to *heel; eyes* fairly deep, *eyebrow* indistinct: *skin* white, no trace of colour, *flesh* pale lemon.

Sprout.—Pink.

Foliage.—*Haulm* erect; no colouring on stem; *young growth* sulphury; *leaf* rather small, rigid, open, no colouring in *midrib; leaflet* small, hairy, medium green, *secondary leaflets* small, rounded, numerous.

Flower.—White, large, numerous, large number in each cluster; *anthers* yellow; *buds* markedly green; *flower cluster stalk* very long, carrying flowers high above foliage; *flower stalks* long, green.

Maturity.—Late maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised by Jones, Streeda, Grange, Co. Sligo, about 1920. Of no commercial value.

OXFORD EARLY.

Tuber.—Round, slightly flattened; *eyes* shallow, much more so that Edzell Blue; *eyebrow* not well defined; *skin* deep purple; *flesh* white, traces of purple ring under skin.

Sprout.—Deep purple.

Foliage.—*Haulm* spreading, bushy; *stem* shows slight purple colour in leaf axils and at base; *wing* practically straight; *leaf* small, open, *midrib* shows slight colour at base and in axils of leaflet stalks of younger leaves; *leaflets* **greyish-green, hairy, pointed;** terminal sometimes tied; *secondary leaflets* small, not numerous.

Flower.—White, does not bloom profusely; *anthers* orange, well developed; *buds* green, with purple band at base, and purple markings; some *berries* produced; *flower cluster stalk* short; *flower stalks* short.

Maturity.—Second early; ripens rapidly.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—**Bolters** occur. This variety is of no commercial importance. Was grown in small areas in the neighbourhood of Dundalk and Newry. In the latter district usually known as Flowers of Faughart. Was sold as Edzell Blue. Its foliage does not bear a close resemblance to Edzell Blue.

PEACH BLOOM.

Tuber.—Round, dented at heel; *eyes* medium to deep, *eyebrow* distinct, *skin* white, with large splashes of **bright deep pink,** colour very pronounced in *eyes; flesh* white.

Sprout.—Bright pink.

Foliage.—*Haulm* tall, upright; *stem* tinged red-purple, with numerous thin branches; *leaf* open, *midrib* with colour pronounced at base and at bases of leaflet stalks; *leaflets* medium green, glossy; *secondaries* small, numerous, rounded.

Flower.—Dark red-purple, tipped white, large, numerous: *anthers* deep yellow, separate **widely in older flowers;** *buds* very dark red-purple, no portion green; *flower cluster stalk* long and coloured; *flower stalks* fairly long, buds drooping.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Origin unknown. Found pretty widespread as a mixture among King Edward in Scotland. Found only in one instance in Ireland, in County Tyrone, where grower believed it to be of American origin.

PEERLESS.

Tuber.—Round, very regular, slightly flattened; *eyes* shallow, *eyebrows* indistinct, *skin* purple, scarcely as deep in colour as Arran Victory; *flesh* white.

Sprout.—Deep purple.

Foliage.—*Haulm* upright fairly tall; *stem* develops considerable amount of purple colour; *leaf* fairly close; *leaflets* rounder, small and of a darker green than Arran Victory.

Flower.—White, numerous, *anthers* **orange, regular;** *buds* **dark greenish purple;** *flower cluster stalk* distinctly stronger than Arran Victory; *flower stalks* longer, carrying buds in drooping position.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight.

General Notes.—*Yield* good, *quality* **poor,** *keeps* well. This variety came into prominence in Co. Down in 1919-20, when seed of Arran Victory was in keen demand. Peerless was sold to a considerable extent as Arran Victory. Reputed to have been raised by Strain, Ballyroney, Co. Down. See Arran Victory. Gone out of cultivation, 1937.

PINK EYES.

Tuber.—Round to long, very rough and irregular; *eyes* deep and dotted all over tuber, *eyebrow* present; *skin* white with pink colour in eyes and pink spots; *flesh* lemon.

Sprout.—Pink.

Foliage.—*Haulm* erect, fairly tall; *stems* develop a fair amount of colour, particularly at the nodes; *leaf* open, fairly large, *midrib* develops colour only at base of leaf and bases of leaflet stalks, where the colour is very pronounced; *leaflets* medium size, cupped, probably from the effects of Mosaic disease, though mottling does not appear; *secondary leaflets* very small.

Flower.—White, not numerous; *buds* green; *flower cluster stalks* short, with purple markings, come off stem much lower down than in the case of Lumper; *flower stalks* short.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Tolerant of the virus diseases.

General Notes.—Resembles Lumper in some respects. Procured from Arran Islands, Galway Bay, where it is more than 100 years in cultivation. The same variety as was extensively grown in Lancashire and other parts of England and Ireland over 140 years ago.

PRESIDENT.

Tuber.—Round to oval, somewhat flattened; *eyes* medium to shallow, *eyebrow* present, *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* erect, tall and vigorous; *stems* branching, trace of reddish purple colour, particularly in leaf axils, *wing* wide and waved; *leaf* **erect, rigid, generally composed of a large terminal leaflet,** two large and one small pair of primary leaflets, open, no colour in *midrib; leaflets* large, crinkled, **rather characteristic shade of light to medium green,** often cupped, *secondaries* very few, small.

Flower.—Red-purple, distinctly tipped white, large, numerous, persistent; *anthers* yellow; *buds* dark reddish purple at base, tips green; *flower cluster stalk* long, carrying flower high above foliage, *flower stalks* long, buds drooping. *Berries* freely formed.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease. Fairly resistant to Blight. Leaf Roll effects very severe, probably more so than in any other variety in cultivation; intolerant of most of the virus diseases, but is a carrier of Virus A (Murphy & McKay), while Virus X produces only a mild mottling. Virus Y produces Leaf Drop Streak. Virus B produces Top Necrosis and Virus D produces Foliar Necrosis.

General Notes.—A Dutch variety, known as Paul Kruger. Raised and introduced by G. Veenhuizen, Sappemeer, Holland, in 1896. *Yield* good, *quality* generally poor, *keeps* well. Extensively grown in Co. Wexford, but not popular in other parts of Ireland. Never popular in Great Britain.

General.—The variety General is identical with President, except that its flowers are white.

PRIDE OF BUTE.

Tuber.—Kidney, tapering to rose end; *eyes* shallow, *eyebrows* present; *skin* purple; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* tall, upright, *stem* mottled purple, *wings* straight; *leaf* **open,** *midrib* purple, colour carried into leaflet stalk, not much into midrib of leaflet; *leaflets* medium green, large, pointed; *secondaries* few, small, rounded.

Flower.—Light blue-purple, small white tips, large numerous; *anthers* deep yellow; *buds* green, with purple markings; *flower cluster stalks* very long, emerges from axils of lower leaf, mottled purple, thin; *flower stalks* long.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Of no commercial value. Very rarely grown.

PURITAN.

Tuber.—Oval, slightly flattened; *eyes* **moderate depth, deeper and more pronounced than in British Queen;** *eyebrows* very distinct, *skin* **white;** *flesh* white, slightly whiter than British Queen and decidedly softer.

Sprout.—Light pink.

Foliage.—Indistinguishable from Early Rose or Beauty of Hebron, except for less colour in stalk and midrib.

Flower.—Indistinguishable from Early Rose or Beauty of Hebron.

Maturity.—Genuine first early.

Disease Resistance.—Susceptible to Wart Disease. Now subject to Blight. Tolerant of the virus diseases. Leaf Roll not seen on this variety.

General Notes.—Yield good, *quality* fair, *keeps* badly. This variety is identical with the American variety White Beauty of Hebron. An old variety, extensively cultivated before Epicure was introduced, especially in Ayrshire.

QUEEN OF THE VELDT.

Tuber.—Kidney; *eyes* shallow, *skin* red, *flesh* tinged lemon.

Sprout.—Deep pink.

Foliage.—*Haulm* spreading: *stems* deep red purple; *midrib* deeply coloured with colour on leaflet stalks; *leaflets* narrow, crinkled, yellowish green.

Flower.—Absent. *Buds* drop before opening.

Maturity.—Second early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised and introduced by the late A. Findlay, Auchtermuchty. Of no commercial importance.

RAEBURN'S GREGOR CUPS.

Tuber.—Round, *eyes* medium, *skin* pink, *flesh* white.

Sprout.—Deep pink.

Foliage.—*Haulm* medium height, upright; *stems* mottled dark-red-purple, branching; *wings* slightly waved; *leaf* open, rigid, *midrib* dark red-purple; *leaflets* medium green, dull; *secondaries* very small.

Flower.—**Red-purple,** large white tips, numerous, *anthers* deep yellow; *buds* red purple.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Origin unknown. Found occasionally as a rogue in some stocks of Kerr's Pink.

RAFTER'S

Tuber.—Round, very rough, not much dented at *heel; eyes* deep, dotted over tuber, *eyebrow* distinct; *skin* light pink, with small white patches; *flesh* **yellow with pink ring under skin.**

Sprout.—Deep pink.

Foliage.—*Haulm* tall and upright; *stems* thin, with a large amount of colour, particularly in leaf axils, branching freely above ground, *wing* very wide, waved; *leaf* open, rigid, two reddish purple parallel lines along midrib and continued into leaflet stalks, disappear on older leaves; *leaflets* more or less pointed, fairly large; *leaflet stalks* fairly long, bearing large secondaries, medium green; *secondaries* numerous, pointed.

Flower.—Light pinkish purple, almost white, very rarely blooms; *buds* fairly freely formed, green base and tips, purple band and markings in buds; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—An old variety procured in Co. Galway. Its history is not known. No commercial value.

RANFURLY RED.

Tuber.—Round, regular; *eyes* fairly shallow, *eyebrows* present and curved; *skin* pink; *flesh* very pale lemon.

Sprout.—Deep pink.

Foliage.—*Haulm* medium height, upright; *stem* mottled red-purple, *leaf* open, drooping, *midrib* red purple; *leaflet* large, fairly dark green, glossy, **terminal** drooping, lower part of *midrib of leaflets* tinged pink; *secondaries* small, pointed, not numerous.

Flower.—White, large and numerous; *anthers* deep yellow, regular; *buds* red purple; *tips of sepals* long and green; *flower cluster stalk* long, mottled red purple; *flower stalks* fairly long. *Berries* occasionally formed.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised by D. McPherson. Sent to Ormskirk for trial by Messrs. Sutton & Sons, Reading, in 1920. Of no commercial value.

READING RUSSET.

Tuber.—Flattened round; *eyes* fairly shallow, *eyebrows* distinct; *skin* **deep pink,** uniform colour all over tuber; *flesh* white.

Sprout.—Deep pink.

Foliage.—*Haulm* **medium** height, spreading; *stem* mottled red-purple; *leaf* open, drooping, *midrib* coloured red-purple, with colour most pronounced at base of leaflet stalks; *leaflets* **narrow, large,** medium green, **long, pointed,** last pair overlapping *terminal*, sometimes tied; *secondaries* fairly numerous, pointed.

Flower.—White, fairly numerous, *petals* large; *anthers* orange, regular; *buds* dark reddish purple, *flower cluster stalk* not long, *flower stalk* medium, buds drooping; *berries* numerous.

Maturity.—Second Early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised by Robert Fenn, Sulhampstead, Berks; introduced by Messrs. Sutton & Sons, 1882. Of no commercial importance at present. Found as a "rogue" in some stocks of Kerr's Pink.

RED CROSS.

Tuber.—Round, *eyes* fairly shallow; *eyebrow* distinct; *skin* white, with considerable amount of pink, usually in bands on the tuber; *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* semi-erect; *stem* branching freely, considerable amount of reddish purple colour on *stem*, *wing* wide and decidedly waved; *leaf* open, fairly long, two reddish purple lines on midribs and leaflet stalks on young leaves, disappearing later. *Leaflet* dark green, fairly large, *leaflet stalks* long; *secondaries* fairly numerous, some round, some pointed.

Flower.—*None* seen. *Buds* small, deep reddish purple, and very hairy, drop readily; *flower cluster stalk short*, *flower stalks* very short and deeply coloured.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Old variety, obtained from Co. Galway. Grown only in very isolated cases. Of no commercial value.

RED CUPS.

Tuber.—Round; *eyes* deep, *eyebrow* very indistinct; *skin* pink, varying in intensity; *flesh* lemon.

Sprout.—Pink.

Foliage.—*Haulm* tall, erect; *stems* have bare, lanky appearance, some colour on stem, but not so much as on Red Rocks, which otherwise have a somewhat similar appearance: *leaf* close, reddish purple colour pronounced in *midrib; leaflet* rounded, **markedly crinkled;** *young growth* sulphury, *secondaries* fairly numerous, medium size, rounded. *Foliage* in general bears a remarkably close resemblance to Rocks.

Flower.—White with green tips, rare; *buds* deep reddish-purple, drop readily; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Now very subject to Blight.

General Notes.—A very old variety, origin unknown. *Quality* excellent, *yield* light. Grown very extensively prior to the famine in Ireland. Cups and Lumpers, the former regarded as the rich man's and the latter the poor man's potato, were practically the only varieties grown in 1846 in Ireland. Still grown in very isolated cases.

RED KIDNEY.

Tuber.—Kidney, *eyes* shallow; *skin* deep pink, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* upright, tall; *stem* medium thickness, deeply coloured: *wing* slightly crinkled; *leaf* close due to the large number of *secondaries*, small, *midrib* deeply coloured with colour carried into the *midrib of leaflets; leaflets* small, *terminal* drooping; *secondary leaflets* **very numerous,** often borne on *leaflet stalks.*

Flower.—White, numerous, *petals* **exceptionally large;** *buds* numerous; short, thick, deep purple; *flower cluster stalk* fairly long and strong; *flower* stalks long, *buds* drooping.

Maturity.—Maincrop.

RED POTATO.

Tuber.—Flattened oblong, *eyes* medium, *eyebrow* straight and very pronounced, *skin* fairly deep pink, *flesh* white, with considerable amount of pink streaks.

Sprout.—Deep pink.

Foliage.—*Haulm* spreading, medium height; plenty of reddish purple colouring on *stems; leaf* **markedly open,** deep colouring in midribs and on leaflet stalks, on *young leaves* colour is carried well into midrib of leaflet; *leaflets* **medium to pale green,** fairly large, **pointed;** *leaflet stalks* long, bearing secondaries; *secondary leaflets* not numerous, fairly large, pointed.

Flower.—White, fairly numerous, *anthers* yellow, not well formed; *buds* **green** with slight purple markings, **the** *greenbase of buds* **is very conspicuous;** *flower cluster stalk* thin, very little colour, long, arising low down on plant, carrying flowers not much above foliage; *flower stalks* fairly long, carrying buds in drooping position, very little colour.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease. Tolerant of the virus diseases.

General Notes.—Origin unknown, but known to have been grown prior to 1860. *Yield* good, *quality* poor, *keeping qualities* fair. Grown only in an occasional isolated area. It is still wonderfully vigorous. A purple-skinned selection of this variety was procured from Co. Tipperary.

RED SKIN.

Tuber.—Round, *eyes* medium; *skin* pink; *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* fairly tall, erect or semi-erect; *stem* branching, red-purple blotches increasing towards maturity, thin; *wing* very thin, straight; *leaf* open; *leaflet stalks* long, colour on *midrib* noticeable only in *axil* of *leaflet stalk* and *axil* of leaf, medium green, dull, small; *secondary leaflets* very small, fairly numerous.

Flower.—White, fairly numerous; *anthers* yellow, regular; *buds* hairy, not deeply coloured; *flower cluster stalk* medium.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight. Some tubers affected with Dry Rot.

General Notes.—Raised and introduced by William Pollock, Bishopton, Renfrewshire, in 1934. Registered by the Scottish Department of Agriculture in 1934. Awarded a Lord Derby Gold Medal in the Ormskirk Trials, 1936. *Quality* excellent, *yield* good. A new variety well worthy of a trial.

RHODERICK DHU.

Tuber.—Round, *eyes* medium, *eyebrow* indistinct, *skin* white, thick, *flesh* white.

Sprout.—Dull light pink.

Foliage.—*Haulm* **upright, tall, vigorous;** *stem* shows little colouring, branching; *leaf* large, rigid, fairly close due to well-developed secondary leaflets, no colouring in midrib; *leaflet* fairly large, pointed, with a **distinct shade of greyish green colour,** hairy; *secondaries* numerous, pointed, well developed.

Flower.—White, not usually numerous, not large; *anthers* generally pale green and malformed; *buds* decidedly pink; *hairs* upstanding, not numerous; *flower cluster stalk* medium length; *flower stalks* fairly long, slightly coloured, buds slightly drooping.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight. Intolerant of most of the virus diseases, but is a "carrier" of Virus B.

General Notes.—Raiser and introducer the late S. T. Farish, Lockerbie. This variety was the outstanding feature at the Ormskirk Trials, when it was first grown there in 1919. Awarded a Lord Derby Gold Medal, 1920. Failed to come up to expectations. Practically out of cultivation as early as 1927. *Yield* medium, *quality* medium, *keeps* well.

ROCKS.

Tuber.—Round, deep dent at *heel; eyes* deep, *eyebrow* present; *skin* of White Rocks white, of Brown Rocks russet, of Red Rocks pink, with colour deeper in eyes; *flesh* pale yellow.

Sprout.—Pink.

Foliage.—*Haulm* tall and erect; *stems* of Brown and White Rocks show faint mottling, *stems* of Red Rock develop a lot of reddish purple colour, *wing* slightly waved, *stems* **bare with a long, lanky appearance,** numerous, thin; *leaf* open, fairly long, stiff and erect; *midrib* shows no colour in White or Brown Rock.

midrib of Red Rock shows some colour, very distinct at base of leaf and base of leaflet stalks; *leaflet* small, medium green, rounded, very markedly crinkled; *young growth* sulphury; *secondaries* fairly numerous, small, rounded.

Flower.—Reddish purple, white-tipped, small, rarely blooms; Red Rock flower decidedly darker red-purple than Brown or White Rock; *anthers* malformed; *buds* green with purple markings, drop readily; *flower cluster stalk* usually short, *flower stalks* short.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—A very old variety. It is not known which of the three types is the older, but in all probability two types were merely sports from the third. Rocks were extensively grown in Ireland and to some extent in Scotland prior to the advent of the Champion. Rocks have also been known as "Scotch Downs", "Green Tops", "Protestants", "Leathers", "Leathercoats". Red Rocks were known as "Peelers".

ROGUE LIKE CARDINAL from Kerr's Pink.

Tuber.—Closely resembles Cardinal.

Sprout.—Deep pink.

Foliage.—*Haulm* erect, fairly tall; *stems* a bit bare of leaves, dark red purple, colour very pronounced; *leaf* fairly long and open, *midrib* dark red purple, particularly on young leaves, with colour carried into leaflet stalks; *leaflets* crinkled, inclined to be rounded, *terminal* overlapped, *leaflet stalks* usually very long, bearing one or two pairs of secondaries; *secondary leaflets* small, numerous, rounded. General appearance of foliage resembles Cardinal.

Flower.—White, only an occasional flower formed, *buds* dark red purple, drop readily.

Maturity.—Maincrop.

Disease Resistance.—Not known.

General Notes.—Occurs as a rogue in some stocks of Kerr's Pink. Very rare.

ROGUE LIKE MAY QUEEN.

Tuber.—Oval, *eyes* shallow, *skin* white, *flesh* white.

Sprouts.—Purple.

Foliage.—*Haulm* low to medium height, spreading; *stem*

mottled blue-purple, *wings* broad, straight; *leaf* fairly open, rigid; *leaflets* large, medium green, glossy, cupped, last pair fitting round terminal.

Flower.—Absent, *buds* clustered, *flower cluster* stalks short.

Maturity.—First early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Origin unknown. Occurs occasionally as a rogue in stocks of Duke of York and May Queen.

ROYAL KIDNEY.

Tuber.—Long oval, somewhat flattened; *eyes* very shallow, mostly on point of tuber; *skin* white, thin; *flesh* white.

Sprout.—Decidedly pink.

Foliage.—*Haulm* semi-erect, medium height; *stems* thin and fairly numerous, very little colour on stem except at ground level; *leaf* fairly open, drooping, *midribs* **of young leaves have decided pink colour at the base, and at the bases of the leaflet stalks;** *leaflet* medium to dark green, pointed; *secondary leaflets* not numerous, **frequently projecting upwards.**

Flower.—Pale reddish purple, extremely rare; *flower cluster* stalks short, *flower stalks* short, buds carried erect or horizontal; *buds* drop off readily, green at base and tips, with purple band and purple markings; *buds* small.

Maturity.—Second early.

Disease Resistance.—Susceptible to Wart Disease. Tolerant of the virus diseases.

General Notes.—Put on the market about 1900 by A. Findlay. Grown for seed purposes, chiefly for export to Spain, where it is grown as an early. Also known as "Queen Mary."

RUBY QUEEN.

Tuber.—Round, somewhat flattened; *eyes* shallow, *eyebrows* distinct, *skin* light purple; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* spreading, compact, *stem* not deeply coloured; *leaf* arched, close, due to short internodes and short leaflet stalks; *midrib* shows little colour, except at base of leaf, where it is

pronounced; *leaflet* fairly large, **dark green and glossy,** crinkled. *terminal* markedly drooping; first pair *primaries* has one or both leaflets frequently tied to midrib, and terminal sometimes tied: *secondaries* not numerous, not well developed.

Flower.—White, medium size, not numerous; *anthers* regular, yellow; *buds* **remarkably green,** numerous, hairs short; *flower cluster stalk* short, *flower stalks* very short; *buds* drop readily: though flower stalks short, buds droop; *flower cluster stalk* frequently bears leaves.

Maturity.—First early.

Disease Resistance.—Susceptible to Wart Disease. Seed tubers very subject to Dry Rot.

General Notes.—Raised by A. Findlay, Markinch, about 1894. Grown fairly frequently in small patches in Co. Donegal. *Yield* fair, *quality* very good, *keeps* very badly. Eightyfold is sometimes grown and sold as Ruby Queen.

RUSSET RURAL.

Tuber.—Flattened oblong to oval, *eyes* medium, *eyebrows* distinct and curved, *skin* russet, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* semi-erect: considerable amount of purple mottling on *stems*, branching, *wings* wide, waved, *leaf* fairly open, *midrib* shows faint reddish purple, colour pronounced in *axils of leaflet stalks* and at *base of leaf; leaflet* fairly large, dark green, glossy; *secondaries* round, not numerous.

Flower.—Deep red purple, distinctly white-tipped, not numerous, *style* protrudes a considerable length, *anthers* pale yellow, a bit irregular; *buds* numerous, purple at base, green tips, *flower cluster stalk* fairly long, thin, comes off low down on plant, carrying flower about level with top of foliage, *flower stalks* fairly long.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—An American variety. A few plants were grown in Co. Donegal. Of no commercial importance in Great Britain or Ireland.

SACKFILLER.

Tuber.—Round to oval: *eyes* medium, *eyebrow* distinct, *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* erect, very tall, vigorous; purple colouring develops as plant matures, to cover practically the whole *stem*, *double wing* on stem very conspicuous, markedly crinkled, *stems* thick and strong; *leaf* open, centre of *midrib* ridged causing two conspicuous grooves along midrib, colour in *midrib* distinct; *leaflet* pale green, probably due to Mosaic, though typical mottling is absent, fairly large, cupped, *secondaries* comparatively small, not numerous.

Flower.—Deep reddish purple, small white tips, profuse, large; *buds* green tinged purple, *flower cluster stalk* very long, thick, and coloured, *flower stalk* markedly coloured, long; *flower cluster stalk* and *flower stalks* usually bear small leaflets and sometimes small leaves.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Origin unknown. Grown in isolated patches, procured from Clonakilty and Athlone. *Yield* fair. Of no commercial value.

SCOTTISH CHIEF.

Tuber.—Round to oblong, flattened, *eyes* medium depth, *eyebrow* very indistinct, *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* upright, medium height; *stem* shows little colour, *wings* waved; *leaf* fairly open and long; *leaflets* greyish green, cupped, *margins* sometimes waved, *leaflet stalks* long, bearing secondaries, *secondaries* numerous, pointed.

Flower.—White, only an occasional flower produced; *buds* green, with purple markings, drop readily, *anthers* pale yellow; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Introduced by Guthrie Bros., Fife, 1922. Of no commercial value. Tubers showed a large amount of cracking.

SEFTON WONDER.

A mutation found in a stock of Great Scot. Similar to Great Scot, except that the skin of the tuber is russet. Sent to Ormskirk for trial in 1923 by J. Tasker, Sefton, near Liverpool, introduced by The Garden Supplies, Ltd., Cranmer Street, Liverpool, 1925.

SHAMROCK.

Tuber.—Round, somewhat flat, dented at *heel*, *eyes* medium to deep, *eyebrow* present, *skin* uniform deep pink, *flesh* white with trace of pink under skin at rose end.

Sprout.—Deep pink.

Foliage.—*Haulm* erect, medium height, *stem* strong, branching, largely mottled red-purple; *leaf* very open, *midrib* dark red purple, often showing in two lines on young leaves, fading on older leaves, *leaflet* rather small, dark green, hard appearance, *leaflet stalks* long, often bearing secondaries. Between the first and second pairs of primary leaflets there is practically always a pair of secondaries resembling small primaries; see Flourball.

Flower.—White, large, numerous, persistent, occasional tinge of reddish purple on back of *petals; anthers* orange, regular; *buds* dark red purple; *flower cluster stalk* long, *flower stalks* long, buds drooping.

Maturity.—Very late maincrop.

Disease Resistance.—Immune from Wart Disease. Very resistant to Blight in both foliage and tubers. Late ripening and Blight resistance appear to be associated. Leaf Roll absent in fields where it was present on other varieties in the same field, and apparently not exposed to any more severe infection; tolerant of most of the virus diseases. Probably more resistant to potato diseases generally than any other known variety.

General Notes.—Origin unknown. Came into a minor degree of prominence in Drogheda district about 1900. *Yield* good, *quality* medium, *keeps* well. Shamrock, Champion II, and Irish Chieftain were probably the best Blight resisters that have come on the market. They possessed few other useful qualities.

SHARPE'S EXPRESS.

Tuber.—Kidney, sometimes curved, a bit irregular, generally tapers towards *heel* end; *eyes* very shallow and mainly on the point of the tuber; *eyebrow* distinct, *skin* white, *flesh* white, slight yellow tinge.

Sprout.—Pink, not so deep in colour as Eclipse. Very few hairs.

Foliage.—*Haulm* upright; *stem* shows only trace of colour; *leaf* **has a very crowded appearance due to very large number of secondary leaflets;** *young growth* shows sulphury colour on top of plant; *leaflets* pointed forward, frequently overlapping, dark green, **small, bright and glossy,** *secondary* leaflets probably more numerous than on any variety except Lochar, which has a somewhat similar leaf.

Flower.—Deep red-purple, with small white tips; rarely blooms except stem is injured. The flower of Sharpe's Express shows more red in its colour than that of any common variety, with the possible exception of Bishop. *Buds* fairly numerous, green, with a considerable amount of purple markings; very hairy, hairs upstanding. *Anthers* well-formed, yellow. *Flower cluster stalk* short, *flower stalks* short.

Maturity.—First early, but not among the earliest.

Disease Resistance.—Susceptible to Wart Disease. Fairly resistant to Blight. Tolerant of most of the virus diseases, but Virus B. produces Top Necrosis; in certain seasons rather subject to Dry Rot.

General Notes.—*Yield* good, *quality* good, *keeps* well. Introduced by Charles Sharpe, Sleaford, Lincs., about 1900. **Bolters** occur freely in some stocks. Good demand for seed in French markets.

SHARPE'S VICTOR.

Tuber.—Flattened oval, regular; *eyes* very shallow, *eyebrow* indistinct; *skin* white, *flesh* **lemon.**

Sprout.—Purple.

Foliage.—*Haulm* spreading, medium height; *stems* distinctly mottled blue-purple, *wing* straight; *leaf* **open,** *internodes* long, *midrib* shows colour only at base and at bases of leaflet stalks; *leaflet* large, rather light green, glossy; *secondaries* few, rounded.

Flower.—Pale blue, large, numerous, *anthers* orange; *buds* **drooping, very dark blue-purple,** hairs numerous and long; *flower cluster stalk* mottled purple, fairly long, *flower stalks* long, coloured.

Maturity.—First early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised and introduced by Charles Sharpe, Sleaford, Lincs., in 1891. *Yield* medium, *quality* fair, *keeps* badly. Of no commercial importance now.

SKERRY BLUE.

Tuber.—Round to oval, irregular; *eyes* medium to deep; *skin* purple; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* fairly erect and fairly tall not as tall as Black Skerry; *stem* **markedly blue purple,** very thin, wiry; *wing* excep-

tionally narrow, waved; *leaf* fairly open, *midrib* deeply coloured with colour carried into *midribs of leaflets*, not so rigid as in Black Skerry; *leaflet* medium size, long, narrow, light green, flat; *secondary leaflets* fairly well developed on older leaves.

Flower.—Dark blue-purple, **characteristic shade,** large, numerous, **no white tips;** *anthers* yellow, regular; *buds* dark purple, small, numerous, not so hairy as Black Skerry; *flower cluster stalk* thin, short, deeply coloured.

Maturity.—Late maincrop.

Disease Resistance.—Long famous for the resistance of its foliage to Blight. Immune from Wart Disease. In this respect differs from Black Skerry.

General Notes.—Origin unknown. Mentioned in the *Farmer's Magazine*, September, 1865, and was said "to be free from blight." It was recommended by Baldwin in his class book *Practical Farming*, 1877. This variety is quite distinct from Black Skerry. The foliage is not nearly as strong and erect.

SNOWDROP.

Tuber.—Long oval; *eyes* very shallow and mostly on point of tuber; *eyesbrows* distinct; *skin* white; *flesh* snow-white.

Sprout.—Light pink at base, tip white.

Foliage.—*Haulm* spreading, medium height, bushy; small splashes of reddish purple colouring near *top of stem*, colour sometimes shows very conspicuously on edge of wing; *leaf* open, long, drooping, and tinged reddish purple at *base; leaflet* **light green,** pointed, **thin,** *leaflet stalks* long; *secondaries* few, small, pointed.

Flower.—White, seldom formed; *anthers* pale yellow; *buds* numerous deep reddish purple, characteristic appearance, hairy; *sepals* long and green, sometimes bearing very small leaves; *flower cluster stalk* long, *flower stalk* very short and deeply coloured.

Maturity.—First early.

Disease Resistance.—Immune from Wart Disease. Now very susceptible to Blight. Tolerant of many of the virus diseases.

General Notes.—Bolters frequently occur. *Keeping* quality very poor. Not of much commercial importance. Witch Hill is identical with Snowdrop. According to Salaman, Snowdrop was raised by Cole and introduced by John Perkins & Son, Northampton, prior to 1881. It was the first variety which was definitely observed to be immune from Wart Disease.

SNOWFLAKE.

Tuber.—Long, irregular; *eyes* deep and dotted all over tuber, *eyebrow* consists of a large **rounded** lump under each eye, *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—*Haulm* erect, tall, vigorous; *stem* develops very little colour, *wings* **markedly crinkled,** *leaf* fairly open, large, no colour in *midrib; leaflet* medium to dark green, lighter shade in young growth, **crinkled** and **glossy,** pointed; *secondaries* very small, not numerous.

Flower.—Reddish purple, tips white, numerous, *anthers* yellow, regular; *buds* reddish purple, tips green, numerous, *flower cluster stalk* strong and long, comes off low down on plant, *flower stalks* mediun length.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Origin unknown, a very old variety, still pretty extensively cultivated in the Ardara district, Co. Donegal. *Yield* good, *quality* medium, *keeps* well.

The name Snowflake has been applied to Langworthy and Abundance.

SOUTHESK.

Tuber.—Round; *eyes* medium; *skin* white, *flesh* white.

Sprout.—Purple.

Foliage.—Haulm erect, fairly tall; *stem* thick, red purple colour very pronounced in *leaf axils; wing* crinkled; *leaf* close, fairly rigid, colour only at base of *midrib*, *leaflets* small, greyish green, hairy; *secondary leaflets* fairly numerous.

Flower.—White, not numerous; *anthers* pale, malformed; *buds* green with dark purple streaks, numerous, drop readily; *flower cluster stalk* short, thin, green, *flower stalk* short.

Maturity.—Late maincrop.

Disease Resistance.—Immune to Wart Disease

SPRY'S ABUNDANCE.

Tuber.—Round, flattened, *eyes* fairly shallow, *eyebrow* distinct, *skin* slightly yellow, *flesh* lemon.

Sprout.—Purple.

Foliage.—*Haulm* erect, tall, vigorous, compact; *stems* fairly numerous, thick and strong, dark blue purple at *base* and in *axils of leaves*, remainder mottled blue purple, *wing* fairly broad and slightly waved: *leaf* open, due to very long leaflet stalks, no colour in *midrib; leaflets* **crinkled,** hard, dark green, hairy, dull, fairly large, pointed; *secondaries* fairly numerous, often borne on leaflet stalks.

Flower.—White, rare, *anthers* often pale and irregular, sometimes yellow and perfect; *buds* dark blue purple, very small, drop early; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease. Foliage possesses considerable degree of resistance to Blight; subject to Common Scab.

General Notes.—Origin unknown, believed to have been raised in Dumbartonshire. Pretty extensively grown in district about Tullamore, Offaly, where it was procured for trial in 1923. *Yield* good, *quality* good, *keeps* well.

STIRLING CASTLE.

Tuber.—Round to oval, *eyes* shallow, *eyebrow* indistinct, *skin* white, *flesh* white.

Sprouts.—Pink.

Foliage.—*Haulm* fairly tall, later tops drooping; *stems* slightly tinged pink, branching freely, *wings* straight; *leaf* large, drooping, fairly close, due to numerous well-developed secondary leaflets, *midribs* of young leaves show slight colouring, with colour most pronounced in axils of leaflet stalks; *leaflets* medium green, dull, fairly large, rounded, *leaflet stalks* long, frequently bearing secondaries; *secondaries* numerous, well developed.

Flower.—Light red-purple, very rare; *buds* dark greenish purple, fade to pink and usually drop unopened; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Early maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised by the Rev. Aikman Paton, Soulseat, and introduced by Messrs. Sutton & Sons, Reading, in 1914. Never extensively grown.

SUMMIT.

Tuber.—Oval, irregular; *eyes* fairly deep, *eyebrow* present; *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—Haulm tall, upright, vigorous; *stems* numerous with a considerable amount of red-purple colour, especially at base; *leaf* fairly close, rigid, *midrib* shows colour only at base and at bases of leaflet stalks; *leaflets* medium green, a bit small; *secondaries* small, not numerous.

Flower.—White, very numerous, large, *anthers* usually pale, malformed; *buds* dark reddish purple; *flower cluster stalk* long *flower stalks* long.

Maturity.—Late maincrop.

Disease Resistance.—Susceptible to Wart Disease. Foliage fairly resistant to Blight.

General Notes.—Raised and introduced by the late W. R. Farish, Dumfries, about 1912. Not a commercial success, largely on account of shape of tubers.

TEMPLAR.

Tuber.—Flattened round to oval, dented at *heel; eyes* shallow, *eyebrow* indistinct, *skin* white, *flesh* pale lemon; *roots* wild, numerous, *runners* long, numerous, show trace of purple colour.

Sprout.—Purple.

Foliage.—*Haulm* erect, very tall, *stem* shows decided blue purple colour at base and at nodes; *leaf* open, rigid, pointing upwards, *midrib* shows colour only at base of leaf and at bases of leaflet stalks; *leaflet* pointed, thin, rather pale green; *secondaries* not well developed, fairly numerous.

Flower.—White, large, numerous, *anthers* yellow, well-formed; *buds* dark bluish purple; *flower cluster stalk* long, carrying flowers well above foliage, *flower stalks* long, buds drooping.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease. Fairly resistant to Blight.

General Notes.—Raised by the late Dr. Wilson, St. Andrews, in 1906, and introduced by J. Roger, Balgrove, St. Andrews, in 1912. *Yield* light, *quality* medium, *keeps* well. Not a commercial success largely on account of poor yield.

THE BARON.

Tuber.—Oval, **too many tubers have tendency to taper towards the heel end;** *eyes* shallow, *eyebrow* present, *skin* white, *flesh* white.

Sprout.—Pink.

Foliage.—Tall, upright, open, moderately vigorous; *stems* show slight pink colouration, more marked at the base, *wings* crinkled: *leaf* close, *midrib* has colour only pronounced at base and at bases of leaflet stalks; *leaflets* dark green, long, pointed, fairly large, wrinkled, glossy, *secondary* leaflets few.

Flowers.—White, somewhat rare.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised by Chas. Brown, Pitnappie, Newtyle, and put on the market by Messrs. Wm. Tasker and Sons, Meigle, 1927.

THE TOWSE.

Tuber.—Round, *eyes* shallow, *eyebrow* indistinct, *skin* **mostly deep pink with pale yellow blotches;** *flesh* pale yellow.

Sprout.—Pink.

Foliage.—*Haulm* spreading, medium height, straggly; a large amount of reddish purple colour on *stems*, branching, *wing* straight; *leaf* small, open, *midrib* pink tinged; *leaflet* small, crinkled, glossy, *terminal* drooping, *secondaries* small, numerous, sometimes borne on leaflet stalks.

Flower.—Red-purple, small white tips, not numerous, large, *anthers* yellow, regular; *buds* dark reddish purple, numerous, some *sepals* long, *flower cluster stalk* fairly long, frequently bears leaves, *flower stalk* short, deeply coloured.

Maturity.—Second early.

Disease Resistance.—Immune from Wart Disease. Very intolerant of the virus diseases. Crinkle makes the variety unrecognisable.

General Notes.—More commonly known as Climax. Introduced by Gemmel, Glassford, Hamilton: sent out as Climax by Smith & Symons, Glasgow. Grown only for exhibition purposes.

THOME BLACK.

Tuber.—Oval to oblong; *eyes* fairly deep and dotted all over tuber, *eyebrow* distinct, rounded, *skin* deep purple; *flesh* yellow, with pronounced purple ring under skin.

Sprout.—Purple.

Foliage.—*Haulm* semi-erect, medium height; some colour on *stem; leaf* fairly close, *midrib* purple, with colour most pronounced at base of leaf and base of leaflet stalks, shows as two lines on young leaves; *leaflets* large, crinkled, the last pair of leaflets overlap terminal, *secondaries* fairly numerous, rounded.

Flower.—White, large and fairly numerous, *anthers* yellow, opening somewhat towards ripening, *buds* blue-purple, green tips, some green bases; *flower cluster stalk* long, sometimes bearing a complete leaf, *flower stalks* long, buds drooping.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—A very old variety in Kilmacrenan district, Co. Donegal. Never known to have been grown on a commercial scale.

THOMES.

Tuber. Oval, beautiful shape; *eyes* very shallow, *eyebrows* indistinct; *skin* very deep purple; *flesh* white.

Sprout.—Deep purple.

Foliage.—*Haulm* semi-erect, fairly tall, vigorous; *stem* coloured very deep dark purple, very few varieties show as much colour; green lobes around stem at base of leaf stalk very conspicuous; *wings* very pronounced, crinkled; *leaf* long and **markedly open,** *midrib* characteristic dark blue purple in old leaves, in young leaves colour shows as two dark purple lines; *leaflets* large, dark green, glossy, *leaflet stalks* long deep colour with colour carried well into midrib of leaf; *leaflet stalks* long, sometimes bearing secondaries; *secondaries* fairly numerous, not well developed.

Flower.—Light blue purple, with distinct small white tips, very large, numerous; *anthers* orange and well developed; *buds* become dark purple, numerous, drooping; *flower cluster stalk* very long, carrying flowers high above foliage, *flower stalks* long and deeply coloured. *Berries* formed occasionally.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—This variety was never grown on a commercial scale. Procured from P. Devine, Newmills, Co. Donegal, in 1925

TINWALD PERFECTION.

Tuber.—Oval, regular; *eyes* shallow, mostly on point of tuber, *eyebrow* present; *skin* white, *flesh* white.

Sprout.—Light pink at base, tip white.

Foliage.—*Haulm* semi-erect, medium height, lower than Up-to-date; some reddish purple mottling on *stem*, *wing* sometimes crinkled, *leaf* fairly close, drooping, *midrib* of young leaves decidedly coloured at base and base of leaflet stalks, fading later, on younger leaves colour carried into leaflet stalks; *leaflet* **rather small, dark green, inclined to be rounded, glossy,** cupped, *terminal* overlapped, *secondaries* numerous, small, rounded, frequently borne on leaflet stalks.

Flower.—Dark reddish purple with distinct white tips, soon fades to a lighter shade; **not persistent, small number of flowers on each** *cluster*, *anthers* **pale yellow, irregular.** *Buds* deep pink, hairs short, numerous upstanding; *flower cluster stalk* **short and thin,** *flower stalks* short, *buds* carried upright or horizontal, never drooping; *petals* inclined to close up more so than Up-to-date.

Maturity.—Maincrop, slightly earlier than Up-to-date.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised and introduced by the late W. R. Farish, Dumfries, in 1914. First tested at Ormskirk, 1916. *Yield* medium, *tubers* always numerous and **small,** *quality* good, *keeps* fairly well. At one time called "the immune Date," but the small size of the tubers was against it. It reached the height of its popularity about 1922. Gone out of cultivation (1937).

TOLEY.

Tuber.—Round to oval, a bit irregular; *eyes* deep, *eyebrow* present, *skin* light pink, with colour pronounced at rose end, *flesh* **yellow.**

Sprout.—Pink.

Foliage.—*Haulm* tall, erect; *stems* very much coloured, somewhat bare; *leaf* very long, open, *midrib* deep reddish purple colour, continued on leaflet stalks and into *midrib* of leaflet, *leaflets* thin, fairly small, edges waved, *leaflet stalks* long, *secondary leaflets* very numerous, often borne on leaflet stalks, round.

Flower.—Light reddish purple, large, fairly numerous, portion of *anther* **frequently becomes a petal;** *buds* dark reddish purple,

green tips, readily drop, *sepals* large, *flower cluster stalk* very long, occasionally bearing a leaf; *flower* **stalks** medium.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease. Intolerant of the virus diseases. Crinkle makes the foliage unrecognisable.

General Notes.—Origin unknown. Very old variety, grown only in a very occasional small patch in some backward districts. Procured in 1923 from Co. Mayo.

ULSTER MONARCH.

Tuber.—Kidney, very uniform; see Figure 74; *eyes* shallow; *skin* white; *flesh* white.

Sprout.—Purple.

Foliage.—*Haulm* medium height, bushy, not quite as tall as British Queen; *stem* strong, slightly pigmented not as much so as British Queen, *wing* slightly crinkled; *leaf* arched not rigid, fairly open; *leaflets* large, dark green, waxy appearance, margins waved; *secondary leaflets* small and not numerous.

Flower.—White, fairly numerous, not as much so as in British Queen, *anthers* orange; *buds* green, frequently drop; *flower cluster stalk* short.

Maturity.—Second Early, but produces tubers of a marketable size earlier than Eclipse.

Disease Resistance.—Immune from Wart Disease. Much more resistant to Blight than British Queen is now.

General Notes.—Raised by John Clarke, Broughgammon, Ballycastle, Co. Antrim; a small quantity marketed in 1936-37. The most promising variety raised in Ireland since the introduction of the Rock about 100 years ago. *Yield* very good, *quality* good, *keeps* well. *Parentage* May Queen X Herald. A new variety that is well worthy of trial.

UP-TO-DATE.

Tuber.—Oval; *eyes* shallow and mostly on point of tuber, *eyebrow* not pronounced, *skin* white, *flesh* white.

Sprout.—Faint pink at base, with white tip.

Foliage.—*Haulm* semi-erect, remarkably vigorous; *stem* thick and strong, branching, tinged pink towards maturity, *wing* waved; *leaf* long, large and fairly close, *midrib* of young leaves

shows pink tinge at base and at bases of leaflet stalks; young growth a bit sulphury; *leaflets* **large, light, green,** pointed, end pair overlapping terminal, **secondaries** large, fairly numerous.

Flower.—Medium, reddish-purple, lightening in shade towards the tips, though not becoming white, numerous large, persistent, *anthers* **orange, regular;** *buds* deep reddish purple, *sepals* long, hairs numerous, upstanding, *flower cluster stalk*, fairly long **and markedly thick,** carrying flowers well above foliage, an occasional leaf occurs on the stalk, *flower stalks* long, holding buds in drooping position.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease. Now subject to Blight, but was considered fairly resistant when first introduced. Leaf Roll Effects probably less severe than on any other variety; very tolerant of most of the virus diseases, but Virus Y produces Leaf Drop Streak and Virus D causes Top Necrosis. These types are seldom present in Ireland. "Carrier" of Virus X and also of Virus B. Subject to Common Scab. Resistant to Dry Rot.

General Notes.—Raised and introduced by Archibald Findlay, then at Portland House, Markinch, Fifeshire in 1893. One of the best and most popular varieties ever put on the market. Still extensively grown in parts of Ireland, where seed is in keen demand for foreign markets. An occasional **Bolter** found. An Up-to-date with white flowers occurs occasionally, and plants with some flowers normal and some flowers white have been found.

UTILITY.

Tuber.—Round, flattened, dented at *heel; eyes* medium to deep, *eyebrow* present, *skin* pink, *flesh* white.

Sprout.—Deep pink.

Foliage.—*Haulm* medium height, semi-erect, vigorous: *stems* show a fair amount of colour, branching, *wing* broad, slightly waved; *leaf* **open, rigid,** two red-purple lines on midrib of young leaves and continued into leaflet stalks; *leaflets* pointed hard, dark green, broad, hairy, slightly wrinkled; *secondaries* small, fairly numerous, sometimes borne on leaflet stalks.

Flower.—Red-purple, tipped white, not numerous: *buds* green with purple markings, very hairy, hairs upstanding; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised and introduced by Stark, Newburgh, Fife. First sent to Ormskirk for trial in 1921 by Messrs. Cameron & Co., Fife, and by Messrs. Wotherspon, Donald & G. Graham, Ltd., Glasgow. Never became of any commercial importance.

WAVERLEY.

Tuber.—Long oval, *eyes* shallow, *skin* uniform deep pink, *flesh* white.

Sprout.—Deep pink.

Foliage.—*Haulm* tall, erect, branching; *stems* numerous, large amount of colour, *wing* distinct and slightly waved; *leaf* long, fairly close, due to large number of secondary leaflets, *midrib* deeply coloured, colour most pronounced at base and at base of leaflet stalks, colour carried into leaflet stalks and a short distance into midrib of leaflet, fades on older leaves; *leaflets* fairly dark green, dull, *leaflet stalks* long, bearing secondaries, large; *secondary leaflets* very numerous, fairly well developed, rounded.

Flower.—White, fairly numerous, small; *anthers* yellow and well formed; *buds* deep red purple, very small green tips; *flower cluster stalk* short, rising from near top of foliage, a bit coloured, *flower stalks* rather short, with buds partly drooping.

Maturity.—Early maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Introduced by Dobbie & Co., Edinburgh. Not grown to any extent. Occasionally found as a " rogue " in some stocks of Kerr's Pink.

WHITE CITY.

Tuber.—Oval to long, sometimes tapering to *heel* end, flattened, *eyes* shallow, *eyebrow* indistinct, *skin* pale yellow, *flesh* pale yellow.

Sprouts.—Pink.

Foliage.—*Haulm* semi-erect, vigorous, fairly tall; *stem* strong, branching fairly freely, no colour shown except a trace at base, *wing* broad or straight, *leaf* **remarkably long and close, due to very numerous and well-developed secondaries,** *midrib* shows no colouring; *leaflets* fairly round, crinkled, dark green, *leaflet stalks* long, often bearing secondaries; *secondaries* numerous, well-developed.

Flower.—Reddish-purple tipped white, not numerous, *anthers* sometimes pale yellow, *buds* bright reddish purple, numerous, drop readily; *flower cluster stalk* short, *flower stalks* short.

Maturity.—Maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Raised by A. Stevenson, Ladybank, and introduced by Messrs. Sutton & Sons, Reading, 1909. A good exhibition variety, but never became commercially popular.

WINDSOR CASTLE.

Tuber.—Round to oval; *eyes* shallow, *skin* white, *flesh* white.

Sprouts.—Purple.

Foliage.—*Haulm* medium height, spreading, *stem* **markedly blue purple at base,** branching, *wings* waved at the top; *leaf* **drooping,** fairly close, *midrib* shows only faint colouring at base, and at bases of leaflet stalks; *leaflet* large, **drooping,** medium green; *secondaries* **pointed upwards, large,** pointed, sometimes borne on stalks.

Flower.—Blue-purple, white tips, not numerous, *buds* dark reddish purple.

Maturity.—Second early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Raised by Rev. Aikman Paton, Soulseat, introduced by Messrs. Sutton & Sons, Reading, in 1914. Yield medium. Not a commercial success.

YAM.

Tuber.—Round to long, dented at *heel; eyes* deep, *eyebrows* long, raised; *skin*, brownish-pink, *flesh* **yellow.**

Sprout—Pink.

Foliage.—*Haulm* fairly tall, upright, tending to spread; *stem* mottled red-purple, **more so than Kerr's Pink,** *wings* waved; *leaf open*, long and drooping, *midrib* **dark red-purple,** decidedly more colour than in Kerr's Pink; *leaflet* medium green, *secondaries* not numerous.

Flower.—White, large, profuse, *anthers* orange.

Maturity.—Maincrop.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Of no commercial importance, except as a "rogue" in Kerr's Pink. This is probably the same potato as mentioned in Lawson's Manual No. 134, in 1836.

YANKEE.

Tuber.—Long; *eyes* pretty deep and fairly well dotted all over tuber, *eyebrow* distinct; *skin* white, with considerable amount of pink at rose end.

Sprout.—Deep pink.

Foliage.—*Haulm* nearly erect; plenty of dark reddish purple colour on *stem*, *wing* broad, straight; *leaf* fairly close, large, *midrib* reddish purple, with colour pronounced at base of leaflet stalks and at base of leaf; *leaflet* large, medium green, more or less round, hairy, *secondaries* fairly large, numerous, often borne on leaflet stalks.

Flower.—Reddish-purple, numerous; *buds* hairy, dark reddish purple, green tips, *flower cluster stalk* very long, carrying flowers high above foliage, coloured, *flower stalks* long, buds drooping.

Maturity.—Early.

Disease Resistance.—Susceptible to Wart Disease.

General Notes.—Origin unknown. Beauty of Hebron type. Procured from Schull, Co. Cork, 1923, and not met with elsewhere. Of no commercial importance.

YANKEE BABY.

Tuber.—Flattened, round to oblong; *eyes* medium, *eyebrow* present; *skin* **white, with large splashes of bright pink;** *flesh* white, frequent tinge of pink.

Sprout.—Deep pink.

Foliage.—*Haulm* semi-erect; plenty of colour on stems, *wing* slightly waved; *leaf* long, **markedly open,** *midrib* deep reddish purple, with colour continued on leaflet stalks and into midrib of leaflet; *leaflets* pointed, *leaflet stalks* very long, sometimes being secondaries; *secondaries* fairly numerous, not well developed.

Flower.—Dark reddish purple, with tips slightly lighter in colour, fairly numerous; *buds* **decidedly green, with purple markings;** *flower cluster stalk* medium length, thin, coloured; *flower stalk* medium, deeply coloured, buds horizontal or drooping.

Maturity.—Early maincrop.

Disease Resistance.—Immune from Wart Disease.

General Notes.—Origin unknown, probably an American variety. Procured in 1923 from Co. Kerry, grown only in very isolated small patches. Of no commercial value, except as an exhibition potato.

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